Electrical World

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Monopoly Through Patents Threatened

THE suit instituted in St. Louis this week against the United Shoe Machinery Company by the Attorney-General will be followed closely by the business world and with much anxiety because the case embodies a definite test of one of the most sweeping clauses in the Clayton law, intended to patch up a weakness in the Sherman anti-trust law. It is well known that by means of patents new forms of monopoly have been created, and while in a few minor points the Sherman law has been applied against such monopolies with success, no great body blow has been delivered for or against the principle. If as a result of the suit the Clayton law is upheld, patent rights will be greatly limited and monopoly through restrictive leases will cease. Whatever the outcome, the case is certain to come before the Supreme Court to determine whether the Clayton law, as an adjunct to the Sherman anti-trust law, is soap or solder.

Insuring a Profit on Holiday Trade

THERE is no time in the year when a fixed policy in regard to prices is as helpful both to the central station and the contractor as in the weeks of preparation for the annual Christmas sales. The amount of money which the small dealer feels it safe to invest in holiday stock depends entirely on his confidence in being able to dispose of that stock at a profit; and in the local market profit cannot be assured as long as there is danger of some other agency offering similar goods at cost. The dealer does not dare stock up heavily on electric toasters if, for instance, there is a possibility that ten days before Christmas the local central station will offer them in a special sale at cost. And yet the central station loses if the dealer fails to enter the market as an electrical merchant. Plans must be laid for the Christmas season if electrical appliances are to be featured as they should be; but the program must embrace both the dealer and the central station, and the opportunity should not be imperiled by destructive competition in any form.

Fans for Winter Service

THIS is the season of the year when thousands of electric fans are stowed away in attics or abandoned to spiders for long months because the public does not appreciate the winter value of a fan and central stations have never seriously endeavored to enlighten it. That a fan is useful to increase the heat of a room is not just theory; it is a simple fact of engineering which can be amply demonstrated in any home that has a fan. It is worth while, therefore, for every central station to advertise the fact liberally and effectively before the fans are put away, because it is easier to arouse interest in the subject now than later.

Rate-Making for the Public

RATE-MAKING is important from the standpoint of both commercial results and public policy. Rates multiplied by the units of business determine the amount of gross revenue, and upon the scale of prices for different classes of service the growth of the central station largely depends. If rate-making were only a commercial problem, it would be simplified. But it is a serious factor in public relations. The general public, however, centers its interest on the maximum rate and shows little concern regarding the costs for other classes. The figure which the mass of consumers pay is the one on which the argument arises. This very interesting question in the rate issue is discussed by Mr. W. W. Freeman in the interview published in this number of the ELECTRICAL WORLD. Though Mr. Freeman finds the cost of small lighting business excessive, he considers it as a tax, as a requirement met in return for the franchise. Viewed in this light, the rate is more a factor in public policy than a matter of strict business. Unfortunately, the expense of business done at a loss is borne by other consumers. If rates are to be made on this basis, there should be a public explanation of the fact so as to prevent future difficulty from other customers who meet the extra cost.

Business Principles for Electrical Contractors

ALTHOUGH many books are available dealing with both the mechanical and business phases of the electrical contracting business, many contractors have sought more specific and detailed information on the fundamental principles of cost-keeping and estimating as well as elementary data on the principles of illumination and some of the more difficult problems encountered in the technical phases of the business. Recognizing this need and also the fact that through the public exchange of what are often known as "business secrets" is it possible to place the electrical contracting business upon a higher plane, Louis W. Moxey, Jr., has prepared a series of articles based upon his experience and observation in the field. In the first few articles, the second of which will be found elsewhere in this issue, the author discusses some of the principles of cost-keeping and estimating, giving a wealth of cost data which will be continued through the articles devoted to these phases

of the business. Although these cost data are peculiar to the firm with which Mr. Moxey is connected and cannot be considered as applicable to the business of any other firm, comparisons will aid other contractors in detecting any errors in their own figures. But the true value of the author's articles on these subjects will be found to lie, not in the presentation of cost figures, but in the presentation and explanation of a practical system of cost-keeping and estimating which has withstood the test of time. The entire series of articles will be found to be well worth the careful study of every electrical contractor, the first few articles, dealing, as just stated, with cost-keeping and estimating, deserving detailed consideration in that the system described will be found to be simple, efficacious and applicable to firms of all sizes. It requires for its successful operation nothing more than the part-time service of the contractor or an employee aided by a stenographer.

Electrical Export Trade

THESE are certainly extraordinary and anomalous days as to export trade, and the United States is as a result confronted by many entirely new problems and situations. Things are now being exported that we never sent abroad before, and of course the foreign demand for war munitions far transcends the wildest hopes and dreams as to what we might be called upon to do in supplying the markets of the world. Thus the exports of New York City alone reached the enormous total of $76,000,000 in the first two weeks of October, but strangely enough not more than $21,000,000 worth were of a distinctively warlike character, although no doubt a far larger proportion would find their ultimate way to the battlefields of Europe.

Just where electricity comes in amid all this wonderful development is not very clear. In fact, the showing is rather, if not quite, disappointing. In our issue of Oct. 9 we gave the figures of seven months and of July in electrical exports. The total for the longer period was $13,171,148, as compared with $12,630,559, a gain of somewhat over $500,000. July, however, showed $2,147,307, as against $1,415,360, or a gain of over $700,000. This is in itself very encouraging, but obviously the seven months at the same rate of advance would have done very handsomely. The question is, whether this July rate can be maintained, and why we are not doing better.

On the surface it would seem that electrical export trade should have had some kind of boom, unless it has been affected adversely by world conditions cutting down all international trade other than that in weapons of destruction. But the neutral markets of the earth have been opened to us as never before, and our competitors who still enjoy the freedom of the seas are seriously preoccupied. It is generally understood, for example, that in England many electrical factories are busy on munitions of war; and, if that is the case, they cannot be turning out electrical goods as well. Indeed, England itself would be on these terms an excellent source of consumption for our electrical goods and have little left for export. This must apply with even greater force to all central Europe, including France, Belgium and Italy, as furnishers to the markets of, say, the Far East and South America. But when one line of electrical goods alone—insulated wires and cables—accounts for $650,000 gain in the seven months, other branches would not appear to be keeping pace, although some of them, as given in our table, bore marks of greater activity.

Perhaps we are not going after the foreign trade possibilities as we should; perhaps we don't know how and have yet the lesson to learn. If so, now is the time to learn it before our European competitors turn again to the arts of peace and with the energy of desperation try to regain lost ground with goods at any old price. The figures of the Bureau of Commerce do not reveal destinations, but it must be true that South America is looking this way and expects to be cultivated by various commercial attentions. In this respect it may not be amiss to quote the warning words of Senator Burton as to methods of winning such trade: "You have to enter upon it with system and earnestness and care. It is very desirable to establish agencies that are permanent and select men who are willing to go there and stay; and I think there will be many native-born, who know the country, who will be loyal and efficient. The highest development for increase of our trade there would be the establishment of retail stores with American goods."

Light Still a By-product

A RECENT paper by Dr. Herbert E. Ives brings up to date our knowledge of the efficiency of commercial illuminants in rather startling fashion. His figures are reduced to show the proportion of the applied energy which is transformed into luminous flux, reckoned in terms of its ability to produce the sensation of light. In other words, these efficiencies given by Dr. Ives are actually adjusted so as to show the proportionate light-giving value obtained per unit input. This basis of reckoning efficiency is what one wants for practical purposes, and the figures presented are certainly not flattering to human ingenuity. In fact, as Dr. Ives somewhat grimly observes, light is at present only a by-product, and certainly the figures show that in the transformations of energy which produce useful light the yield falls shockingly far short of what might be theoretically attainable. Of the twenty illuminants studied, the list is headed by the yellow-flame open arc and the quartz-mercury arc, while the kerosene lamp and the open-flame gas burner drag along at the foot of the list with a net luminous efficiency of less than a twentieth of 1 per cent. The positions of honor are taken on 7.2 per cent and 6.8 per cent respectively for the flame arc and the quartz tube, but, inasmuch as these both require steadying resistances not here taken into account, the corrected figures will probably stand at not over 5 per cent to 6 per cent. On this rating inclosed carbon arcs fall just below 1 per cent, while the best

gas-filled incandescents range up to a shade over 3 per cent.

One is tempted to raise somewhat fervid inquiry as to what becomes of the rest of the energy, and the obvious answer is that it goes off in radiation either totally invisible or of comparatively slight luminous value. Many luminous sources lose heavily from heat carried off by convection and conduction, as, for example, the incandescent gas burner, where about five-sixths of the applied energy is lost in this particular way, leaving a net efficiency even in the high-pressure lamps of about 3 per cent. Oddly enough, the two sources mentioned as the most efficient also lose severely from the same cause. The tables show only too plainly that all our present methods of obtaining light are exceedingly crude. No way has yet been discovered of so utilizing energy as to transform it into radiations which we really want for seeing purposes. Pure temperature radiation is limited as to possible efficiency by the relatively low temperature which can be endured by any solid radiator. Hot gases, which give selective radiation, give a chance for higher efficiency, but even here there are serious practical limitations. What can be done by more direct electrical excitation of the atom and the electron remains yet to be seen, for up to the present time there is little of promise. In high-frequency oscillations there may be hope, uncomfortable as are the distribution problems involved in their use. In quite another line come the chemical processes of excitation artificially practised by our old friend the firefly and certain photogenic bacteria. From this standpoint a chemical lamp may be the last word in efficiency, but the chance of getting it seems now too remote to be a cause of worry to the central-station operator.

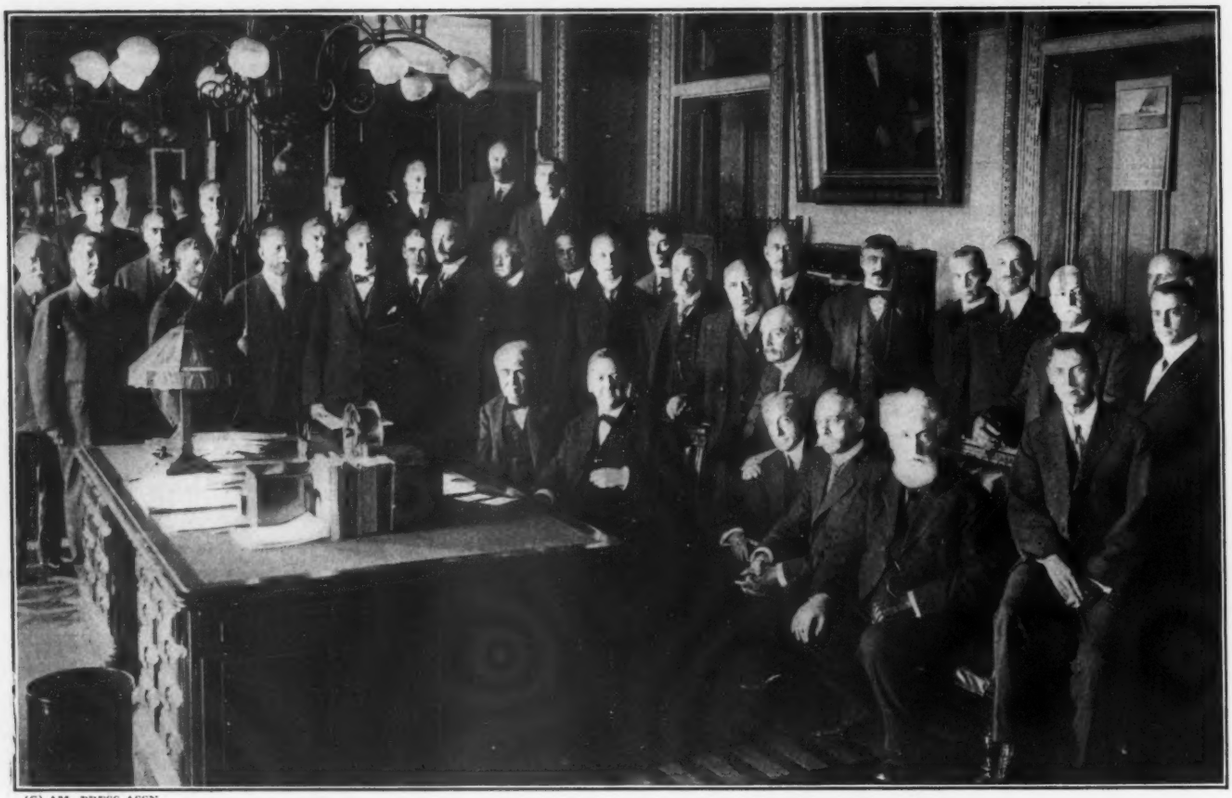
Operating Boilers Over Rating

FORCED draft has thus far been confined chiefly to large generating stations and has also been utilized as an expedient for handling peak demands economically. If, as seems to be the case, the total saving secured directly or indirectly justifies the cost of the equipment to produce the draft, then medium-sized stations should be able to use this method of driving, especially when they reach a point where the load carried requires changes in boiler and stack arrangements. In the use of forced draft, however, there are certain engineering problems which detract somewhat from the advantages. The operation of boilers at high ratings and over ratings, for instance, results in excessive temperature changes which are hard on firebrick and furnace construction. Considering possible operating economy, saving in boiler investment, labor and fuel, it is questionable whether it is more economical to use good coal with sufficient boilers to carry the maximum load and less firebrick, or employ forced draft, a lower grade of coal and more firebrick. Experience shows that furnace and boiler deterioration is more than offset by the saving possible in forced driving. In any case the operation of the boilers at over ratings is intermittent and of comparatively short duration, so that the return on the investment necessary to justify the draft which is represented by the operating saving is the controlling factor. A prime-mover committee of the National Electric Light Association has cited an instance where a total saving equal to 16 per cent of the operating costs resulted from the design of a station to use forced driving. Boiler operation at high rating fits in well with the requirements of parallel and stand-by steam stations for hydroelectric systems where rapidity of picking up load irrespective of atmospheric conditions is of prime importance. For the utility station, large or small, with a considerable peak load the flexibility, readiness-to-serve and economy which result from forced draft make the latter worthy of consideration.

Practical Voltage Regulation

MANY central stations know very little about the regulation which obtains on their systems. While there are nominal requirements which are nominally lived up to, these are not always due to knowledge of the facts. It is hard to define what good regulation means, particularly when one is dealing, as is practically always the case, with combined lighting and power loads. A 2 per cent variation executed suddenly and frequently may be annoying, whereas one twice that size coming on and leaving gradually would hardly attract attention and certainly would not cause very much inconvenience. Moreover, the voltage should not be subject to noticeable fluctuations during the period when the lamps are in circuit. What happens to the pressure, for instance, between 5 p. m. and 10 p. m. is a great deal more important than variations between midnight and dawn. With the increasing use of appliances there is added chance to overload circuits in a way that may cause trouble. To adjust the regulation to the needs of the service requires precise knowledge of what the conditions are, and this not very many stations take sufficient pains to ascertain. It is a matter of very practical importance whether a particular line must be reinforced if a little extra load comes upon it, yet the information as to the probable effect of that load is commonly not forthcoming.

A good deal more care ought to be taken with voltage surveys, with the purpose both of improving the regulation when necessary and of fully loading the lines when practicable. The copper investment of almost any plant is serious enough without aggravating it by finical requirements of extremely close regulation. The voltage ought to be maintained so as to cause no inconvenience to the consumer without undertaking always and everywhere to provide him with regulation the exactness of which he does not appreciate even if it is pointed out to him. Certainly more plants sin by too poor regulation than by too good regulation, yet there are few which do not burden themselves with unnecessary care at certain points of the distribution. The moral is to keep a close check of what is actually going on by persistent voltage inspection.



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The First Meeting of the New Naval Advisory Board at Washington

Already the Naval Advisory Board, appointed by the Secretary of the Navy upon nominations made by the national engineering societies, is occupied with its important task of reviewing inventions and improvements proposed for adoption in the navy. Comprising some of the leading inventive and engineering talent of the country, the board will make its own studies of naval problems and has recommended the institution of a five-million-dollar experimental plant and shops for the investigation and development of ideas and plans under study by its members. An annual appropriation of $2,500,000 to $3,000,000 would be required to maintain this great experimental establishment. In the picture above, taken on the day of the board's first meeting in the Navy Department Building at Washington, Thomas A. Edison, chairman of the board, is seen seated upon the right of Secretary Josephus Daniels, and behind them stands Peter Cooper Hewitt, who at this meeting was elected vice-chairman of the board. Others in the group are B. G. Lamme, W. R. Whitney, Arthur G. Webster, A. M. Hunt, Alfred Craven, Spencer Miller, W. Le Roy Emmet, Matthew B. Sellers, Hudson Maxim, Thomas Robins, Howard E. Coffin, Andrew L. Riker, Henry A. Wise Wood, Elmer A. Sperry, William L. Saunders, Benjamin B. Thayer, J. W. Richards and Lawrence Addicks.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

Tying Leases Temporarily Enjoined by Federal Court in Clayton Law Test

The first important government suit under the Clayton anti-trust act was begun in St. Louis on Oct. 18 against the United Shoe Machinery Corporation, its subsidiaries and a score of individuals. The petition filed in the United States District Court by direction of Attorney-General Gregory alleges unlawful practices that substantially lessen competition and tend to monopoly.

The government asked for an order restraining the company from enforcing the contracts by which it binds lessees of its machines not to use the machines of competitors. Judge Dyer granted a temporary injunction against the enforcement of the contract clauses complained of, and set Oct. 27 as the date for a hearing. The government asked also for a permanent injunction against these clauses as illegal and void.

The government's petition charges that the United Shoe Machinery Company is a monopoly controlling 98½ per cent of the trade in shoe machinery in the United States, its principal business being the making and leasing of these machines; that in certain instances it has fixed and is fixing the prices of such machinery on the condition that the lessee or purchaser shall not use the machinery, supplies, or other commodities of its competitors; that it grants rebates on prices fixed in some instances in consideration of the use by a lessee of other of its machines, and that other leases contain clauses whose effect is to establish prices 10 per cent less to those who agree not to use the machinery supplied by competitors than to those who do not so bind themselves.

These clauses and others with the same purpose and effect, according to the petition, are being enforced by the shoe company, which has written leases with such clauses executed not only before the passage of the Clayton act in October, 1914, but since that time as well.

The new suit is the third anti-trust action begun against the same concern by the Department of Justice in the last few years. Not only is the civil suit to dissolve the concern under the Sherman law now pending in the Supreme Court, but suit under the criminal provisions of the same statute still is pending against some of the officers and directors.

ST. LOUIS MEETING OF A. I. E. E.

Public Utilities Operation, Pole Preservation, Transmission, and Magnetic Topics Discussed During Two-Day Session

Two hundred and one members and guests were registered at the St. Louis meeting of the American Institute of Electrical Engineers, held on Tuesday and Wednesday of this week at the Planters' Hotel, St. Louis. F. L. Hutchinson, secretary of the A. I. E. E., who was present, complimented the St. Louis Section on the interest shown and on the wide scope of its activities. S. N. Clarkson, chairman of the section, opened the meeting, and addresses of welcome were delivered by Mayor Kiel of St. Louis, H. H. Humphrey for the local Jovians, and J. W. Woerman for the associated engineers' clubs of St. Louis.

Technical Topics at Morning Session

The characteristics of repulsion-start induction motors were compared with those of other alternating-current and direct-current motors in a paper, entitled "The Repulsion-Start Induction Motor," presented by Thomas L. Hamilton. A method was described for studying the performance of existing motors of this type and predetermining the characteristics of future designs.

In Val. A. Fynn's paper on "The Single-Phase Squirrel-Cage Motor with Large Starting Torque and Phase Compensation" a new single-phase motor having a large starting torque and operating at unity power-factor was described. Results of performance tests were included.

The paper on "The Calculation of the Long-Distance Transmission Line Under Constant Alternating Voltage," by George R. Dean, contained an explanation of how the voltage and current at any point in a line can be determined by separating the real and imaginary quantities in the general solution of the differential equations expressing the relations between these two quantities. Numerical examples were worked out in detail.

C. W. Place, in his paper "Automatic Control," discussed how far it is advisable to go in applying automatic control. He pointed out that eliminating the human element in routine operations is one of the most effective means of preventing accidents.

Public Utility Management Discussed at Evening Meeting

Several methods which have been adopted in different cities to regulate public-utility earnings were cited in a paper, entitled "Public Utility Management," by Philip J. Kealy, and their merits were discussed.

Mr. Kealy's paper was discussed by C. A. Hobein, M. G. Lloyd and L. B. Cherry.

A paper entitled "Recent Results Obtained from the Preservative Treatment of Telephone Poles" was presented by F. L. Rhodes and R. F. Hosford. In it the results of experience with treated poles were analyzed. Among the subjects covered were rates of decay, increase in life by treatment, effect of seasoning, and characteristics of damage caused by decay and by insects.

In discussing this paper L. H. Von Shrank asserted that the enhancement of the life of timber through preservation treatment is directly proportional to the amount of preservative used. C. H. Teesdale declared that brush treatment of non-durable woods does not pay.

The facilities for research at the University of Illinois were described and the nature of investigations undertaken was outlined in a paper entitled "The Engineering Experiment Station of the University of Illinois," by Ellery B. Paine.

In a paper entitled "The Magnetic Properties of Some Iron Alloys Melted in Vacuo," by Trygve D. Yensen, attention was called to the fact that iron alloys containing 0.15 and 3.4 per cent silicon, after annealing at 1100 deg. C., have a maximum permeability above 50,000 and hysteresis losses of one-eighth to one-third that of commercial silicon steel. The 3.4 per cent silicon alloy has a specific resistance nearly five times that of the 0.15 per cent alloy, making it particularly desirable where the eddy-current loss must be low.

Thomas Spooner, John D. Ball, Morgan Brooks, M. G. Lloyd and L. T. Robinson took part in the discussion.

It was pointed out in a paper on "The Effect of Displaced Magnetic Pulsations on the Hysteresis Loss of Sheet Steel," by L. W. Chubb and Thomas Spooner, that the hysteresis loss in sheet steel will not follow the Steinmetz law if the reluctance of the magnetic circuit is subjected to high-frequency small-amplitude fluctuations in reluctance, as happens in stator and rotor teeth. A quick and accurate method of obtaining data for hysteresis loops was explained.

The results and analyses of tests to determine losses in hysteresis loops where the magnetism is carried through cycles in which limiting values of flux are different were given in a paper on "The Unsymmetrical Hysteresis Loop," by John D. Ball.

H. Weichsel, in his paper on "Decomposing Magnetic Fields into Their Higher Harmonics," explained how long mathematical operations can be avoided in analyzing magnetic fields for their components by considering each wave as composed of a number of triangular waves displaced as to phase.

Among the many entertainment features arranged by the St. Louis committee were a Jovian luncheon Tuesday, at which Norman S. Storer, the speaker of the day, gave a résumé of steam-railroad electrification; an automobile ride to Sunset Inn; a luncheon at the City Club on Wednesday, and a dinner and theater party.

Formation of Public Utilities Section, National Safety Council

At the fourth annual safety congress of the National Safety Council, held in the Bellevue-Stratford Hotel, Philadelphia, on Tuesday, Wednesday and Thursday of this week, a Public Utilities Section was organized and the following officers were elected: Chairman, H. C. Lucas, Philadelphia Electric Company; vice-chairman, Alonzo P. Ewing, Detroit City Gas Company, and secretary, G. H. Smith, Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.

The sectional meeting devoted to public utilities was held on Wednesday morning and was presided over by Dr. E. B. Rosa of the Bureau of Standards, Washington. There were six ten-minute discussions on the following topics "Linemen and Their Hazards," by C. B. Scott, manager of the bureau of safety, Middle West Utilities Company, Chicago; "Danger of Low-Tension Shocks," by H. S. Warren, American Telephone & Telegraph Company, New York; "Hazards of High-Tension Lines," by B. E. Morrow, chief engineer Utilities Mutual Insurance Company, New York; "Hazards of Gas Works," by J. B. Douglas, manager claim department, United Gas Improvement Company, Philadelphia; "Hazards of Street Work," by E. C. Spring, assistant to the president of the Lehigh Valley Transit Company, Allentown, Pa., and "Education of Street-Car Platform Men," by F. J. Wornock, claim agent Mahoning & Shenango Railway & Light Company, Youngstown, Ohio. In addition to Mr. Warren's discussion, telegraphed from the West, Elam Miller of the same company read a paper on "Low-Tension Shocks."

Working Together in the Interest of the Electric Vehicle

PRACTICAL illustrations of just how the electrical interests may increase the sale of electric vehicles were presented before the sixth annual convention of the Electric Vehicle Association of America at the Hotel Statler, Cleveland, on Oct. 18 and 19. Papers and discussions indicated that the vehicle manufacturers and the central stations were closer together in their efforts to promote the sale of electric vehicles than ever before. Central-station men, vehicle manufacturers and battery and accessory makers were in attendance at the meeting. The registration numbered 300, divided as follows: Accessories, 65; garages, 4; car manufacturers, 45; battery makers, 54; central stations, 90; press, 18, and unclassified, 20.

President John F. Gilchrist of Chicago, in his opening address, called attention to the value of concerted action between the various groups of members of the association, not only in promoting the sale of the electric vehicle but in banding together for mutual aid in meeting unfair and unintelligent regulative activity on the part of local municipal authorities or State or federal boards. As an example of co-operation between local interests he cited the new passenger-car parking system which has been worked out in Chicago. The City Council passed a municipal ordinance limiting to thirty minutes the maximum time a vehicle may stand on the curb. This threatened to put the electric vehicle out of business, since such cars are usually driven by the owners and no chauffeurs are available to take the cars away and bring them back. Co-operation between the garage owner, the manufacturer and dealer, and the central-station company has, however, made possible a combined parking plan.

A lady coming downtown may stop at the Michigan Boulevard Electric Shop, we will say. She steps in and tells an attendant when she will return for her car. The clerk takes the key and sees that a chauffeur takes the car to the parking space in Grant Park and returns it at the time desired. There is no charge to the owner of the car for this service. The necessary expense is borne by the manufacturers, dealers and garage men.

A. Jackson Marshall, secretary of the Electric Vehicle Association, in his report of progress, and Walter H. Johnson of Philadelphia, chairman of the central-station co-operative committee, also called attention, among other points, to the practical value of co-operative effort, in talking in general terms to show what has been done and what can be done. Mr. Johnson, for example, summarized six factors in practical co-operation, as follows:

First—All central stations should join the Electric Vehicle Association.

Second—The central station should maintain an electric-vehicle department, headed by a competent storage-battery engineer.

Third—Central stations should use electric vehicles—both trucks and passenger cars—in every line of work wherever possible.

Fourth—Central stations should furnish the communities in which they are situated with conveniently situated garage facilities, including facilities for furnishing boosting charges in the proper localities.

Fifth—Advertising. Central stations should make adequate appropriations for electric-vehicle publicity in their particular localities. Where manufacturers or agents are not active or are not well equipped along this line, should the central station be equipped to loan trucks or passenger cars for demonstrating purposes?

Sixth—Central stations should determine upon the feasibility of a battery service or a garage and service-station plan, whichever seems to be the more practical and resultful method of obtaining and retaining the electric-vehicle battery-charging load.

Other speakers, both in papers and in discussions, brought out the practical value of co-operation. A paper which received especially favorable comment, "The Electric Taxicab," by I. S. Scrimger of the Detroit Taxicab & Transfer Company, showed in a practical way how the central station and the independent garage company could co-operate in the maintenance and placing of suitable charging stations. The Detroit Taxicab & Transfer Company operates twenty-seven cabs twenty-four hours a day. By arranging curb charging stations at the various hotels this company has been enabled to operate most successfully.

OVER COUNTRY ROADS BETWEEN CHICAGO AND CLEVELAND THIS RUNABOUT MADE 142 MILES IN ONE DAY

With mud up to its hubs at times, the Chicago cabriolet roadster pictured above completed the 424-mile trip from Chicago to the Cleveland convention in an actual running time of 28.25 hours, including a 15-mile detour to avoid a road closed for repairs. On the third day of the trip, when fair roads were encountered, the car accomplished 142 miles.

Closer Relations with the N. E. L. A.

On the second day of the convention the Electric Vehicle Association took a most important step to cement further close co-operation between central-station and electric-vehicle interests by adopting a resolution suggesting that the incoming administration of the E. V. A. take steps to combine forces with the National Electric Light Association. E. W. Lloyd, president of the National Electric Light Association, addressed the convention and called attention to the possibility of concerted action in the technical and public relations of the industry. Mr. Lloyd said that he believed the papers to which he had listened at this meeting should be read by every man in the central-station industry. He believed that the association could advance its interests in no better way than by establishing a method of getting

this particular subject before the other interests of the electrical industry. He called special attention to the possibility that the N. E. L. A. might organize on a basis such that it would have available a staff of trained specialists to undertake the solution of the problems which face the industry as a whole, instead of relying upon the individual efforts of various unrelated groups in the industry. In this way, he said, concerted action could be taken with respect to municipal, State and federal regulation, which is growing everywhere.

Advantages of Electric Vehicles

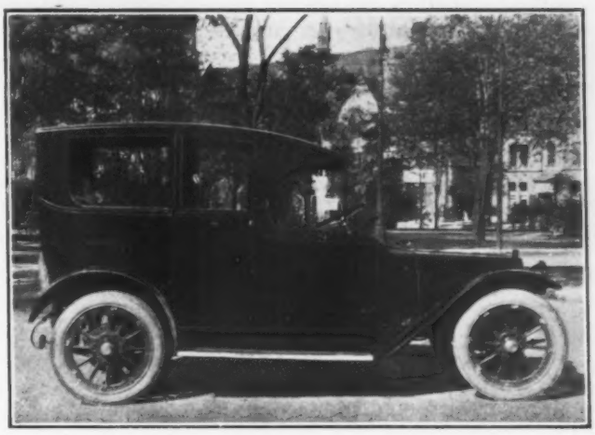
Among the papers which brought out interesting discussion were those by George H. Kelly on "Problems We Are Facing and How They May Be Met," Charles A. Ward on "The Field for the Small Electric Delivery Vehicle," T. V. Buckwalter on "Industrial Trucks in the Service of the Pennsylvania Railway Company," H. H. Holding and S. G. Thompson on "Comparative Development of the Commercial Power and Electric-Vehicle Loads," A. J. Slade and R. D. Dumont on "Electric Vehicles in Municipal Service," and W. J. Miller and S. G. Thompson on "The Comparative Operation of Electric and Gasoline Machines in the Same Service."

These papers, as a group, showed, first, that the electric-vehicle interests are emphasizing the fact that the electric vehicle is not the only commercial vehicle for transportation purposes. Several speakers showed that the gas truck has its place in the transportation problems of a city, but that in many cases electric vehicles are very much cheaper in maintenance and operating cost. In general, where short hauls, slow speeds and many stops form a part of the transportation problem the gasoline vehicle cannot compete successfully with the electric.

Industrial Trucks in Railroad and Factory Service

Especial attention was called to the possibility of a much wider application of electric trucks for industrial purposes. Mr. Buckwalter's paper deserves especial mention because of the very complete details of cost and of daily performance of regular shop trucks, baggage trucks and tractors in use by the Pennsylvania Railroad Company. The industry has come to think of the commercial truck and the pleasure car as the two divisions of electric transportation. Mr. Buckwalter's paper indicated in a most interesting way the possibility of the industrial truck in small sizes. In discussing this paper T. H. Schoepf of Pittsburgh stated that in the Westinghouse factory the small electric shop truck had been of practical service as one link in the inter-factory transportation system. In one instance one truck replaced sixteen laborers. The Westinghouse company now has eight such trucks in operation. Further discussion of this question of industrial trucks showed that in many cases they could be combined with trailers, particularly where loads taken from one station to the next could not be immediately unloaded from the truck. By means of suitable bodies or trailers it is possible to carry loads from one point to the other without tying up the electric truck itself.

Another most important paper was that dealing with electric vehicles in municipal service, which showed how they can be used in fire departments, in street-cleaning, refuse-collection, police-patrol and ambulance service, and by boards of education, departments of water, gas and electricity supply, departments of public works, government printing offices, and so on. The paper took up each of these possible applications of the electric vehicle and showed costs and statistics as they have been developed in different cities. The comparisons, in general, were very favorable to the use of electric trucks for these different services. The authors believe that the economy of the electric vehicle is due in a large measure

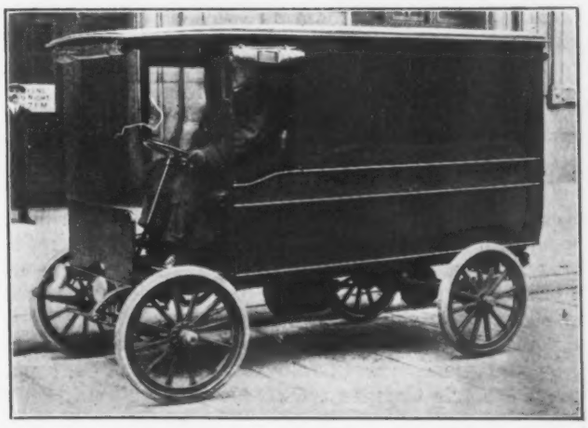


ONE OF DETROIT'S TWENTY-SEVEN ELECTRIC TAXICABS—TWENTY MORE ARE NOW BUILDING

The rate is 70 cents for the first mile and 40 cents for each additional mile, for one or four passengers. The Detroit public seems to prefer the electric cabs to gasoline cars, and in instances passengers have willingly waited 45 minutes or more for an electric conveyance when gasoline cabs were standing by awaiting passengers.

to its long life, low depreciation, freedom from mechanical repairs, and reduced tire cost. They point out, however, that the electric vehicle is not always the best solution of the particular municipal problem, because of local conditions. Discussion developed one interesting point—that in all conventions of gas-car manufacturers much emphasis is placed on the question of what shall be done with second-hand cars in order to preserve the market for new cars. The electric-vehicle manufacturers can never have this problem to face in anything like the proportion that the gas-vehicle manufacturers have, because of the relatively longer mechanical life of the electric car.

Points in the different papers and in the discussions by vehicle manufacturers and central-station men indicate some of the self-advertising possibilities of the electric vehicle. It was stated on the floor that Detroit's electric taxicab service was doing as much to advertise the advantages of the electric vehicle to the public as any one element in the industry. So effective is this electric service that several business men in Detroit, and visitors to the city as well, have stated their intention to buy electric vehicles after seeing the service that the taxicabs render in Detroit.



THE 750-LB. ELECTRIC DELIVERY WAGON WHICH MADE THE 734-MILE RUN FROM NEW YORK TO CLEVELAND

The overland trip from the New York Electrical Show to the Cleveland convention—733.7 miles—was accomplished without a mishap by this "Ward special" wagon in eleven days, on 1064 amp.-hr. These cars have been designed for the delivery service of grocers and tradesmen and are being sold in New York and surrounding territory on a deferred-payment plan.

Mr. Marshall, in his report, also emphasized the self-advertising possibilities of electric-vehicle service, calling attention to lectures on electric vehicles and to the co-operative work with the Society of Automobile Engineers and the motion-picture manufacturers. For several months the association has been working with motion-picture producers in an effort to have electric vehicles, instead of always gasoline vehicles, introduced in the better productions. The electric vehicle is peculiarly adaptable to motion-picture work. The association has been active in the preparation of articles for the general press and the newspapers, and the interest of these various media in the electric car seems to indicate a popular interest in everything electric.

Another interesting feature of the convention was the presence of several electric cars, two of which had come to Cleveland from distant cities on their own power. The Ward special electric car, which made the trip from New York, brought a letter of congratulation from Arthur Williams, president of the Electric Show Company of New York, to John F. Gilchrist, president of the Electric Vehicle Association. The Ward car made the trip from New York at a cost for energy of $8.25. It was charged twenty-five times, most of these charges being simply boosts for the batteries. A more detailed description of the Ward car was given in the ELECTRICAL WORLD for Oct. 16.

The Walker Electric Company's Chicago Electric runabout and the electric taxicab from Detroit were also on exhibition. The Walker car made the trip from Chicago in a net time of twenty-eight and one-quarter hours.

Sixteen different manufacturers exhibited their products at the hotel during the two days' convention.

New Officers for 1916

The report of the nominating committee was presented on Tuesday afternoon, and the following officers for 1916 were elected: President, Walter H. Johnson, Philadelphia; vice-president, E. S. Mansfield, Boston; treasurer, H. M. Edwards, New York; directors, William H. Blood, Jr., Boston; P. D. Wagoner, New York City; G. H. Kelly, Cleveland, and John F. Gilchrist, Chicago.

Federal Court Orders Refund of Income Tax to Ohio Utility Companies

Verdicts were rendered by consent in the United States District Court at Cincinnati, Ohio, on Oct. 14 by which a number of electric railway companies and the Cincinnati Gas & Electric Company will be refunded the income tax they paid to the Collector of Internal Revenue, amounting in all, with interest, to $52,818.33. These companies all lease their properties to operating companies and contested the claim of the government that they are obligated to pay this income tax when they performed only such acts of business as were necessary to carry out the terms of their leases. The verdict in the United States District Court was against them, but this was reversed some time ago by the Appellate Court, and the case was remanded to the District Court with instruction to render judgments in accordance with the prayer in the petitions. The following companies were given judgments for the amounts named: Cincinnati Gas & Electric Company, $35,627.58; Cincinnati Street Railway Company, $11,926.60; Indianapolis, Columbus & Eastern Traction Company, $2,986.66; Columbus, Newark & Zanesville Electric Railway Company, $447.66; Fort Wayne, Van Wert & Lima Traction Company, $538.20; Dayton & Western Traction Company, $977.67, and the Columbus, Newark & Zanesville Electric Railway Company, $313.96.

Load Dispatching on Large Generating and Distributing Systems Discussed Before A. I. E. E. at Boston

Pierce Kent, chief of the electrical operating department of the Boston Edison company, and W. T. Masters, superintendent of electrical operation of the Boston Elevated Railway, addressed the Boston branch of the A. I. E. E. Oct. 13 on the subject of load dispatching. Mr. Kent described the load-dispatching facilities at the L Street station in South Boston, which is the operating headquarters of the largest central-station system in New England, covering about 700 square miles of territory and extending from the Rhode Island line to points situated about 25 miles west and north of the city of Boston.

In May, 1914, two rooms were set apart at L Street for this work, one containing a complete two-position telephone switchboard and a dummy bus and transmission-line board showing the entire high-tension system with all oil switches, while the other contains a kitchenette and comfortable beds for the use of the operators under emergency conditions. The upper part of the board is of wood, for easy alteration, and both oil and disconnecting switches are shown. The lower portion is of fireproof construction and shows all station switches on the 2300-volt, 6900-volt and 13,800-volt lines, with pilot lamps automatically indicating the position of switches within the building.

Load Transfers Must Be Reported to Dispatcher

On the Boston Edison system the load dispatcher is in close touch at all times with substation operators. The latter are allowed to throw machines on and off live buses without special reports to headquarters, but no loads can be transferred from one transmission line to another without the consent of the dispatcher on duty. One dispatcher and one telephone operator are always on duty in the room, and a second dispatcher assists during the peak. Besides direct telephone lines to substations the company relies upon the local Bell system via different routes, so that it is a very unusual situation for the dispatcher to be out of communication with any substation. In this event the station operator must take the responsibility until connections are restored. Lines can be taken out of service only by a permit from the dispatcher, who has charge of tagging and protective measures. Upon completion of repairs the man applying for the cutting out of a line must report back to the dispatcher before it can again be thrown into service. Mr. Kent said that the operation of the system has been greatly improved by the use of dispatchers, and that the duration of trouble has been reduced by more than one-half in many instances.

Multi-recorders to Show Oil-Switch Operation on New Jersey System

In commenting on the discussion, N. L. Pollard of the Public Service Corporation of New Jersey emphasized the usefulness of the dispatching plan for controlling electrical distribution over large areas, and J. T. Lawson, chief operator of the New Jersey company's staff, described load-dispatching practices on the latter system. Plans are afoot for the installation of multi-recorders showing the exact time and sequence of the opening and closing of oil switches, an arrangement which it is hoped will throw considerable additional light on the causes of operating troubles. Automatic lamps showing switch operation are also of great help to the dispatcher, and an opportunity exists for the connection of switches on the outer parts of the system, as well as those in the generating plants, to the pilot lamps on the load dispatcher's board.

JOVIAN CONVENTION AT CHICAGO

T. A. Wynne of Indianapolis Chosen Jupiter for 1916—Commercial Section Addressed by Men Prominent in the Industry

The three days Oct. 13, 14 and 15 were busy ones for the 800 delegates attending the thirteenth Jovian convention in Chicago. From the informal opening of the convention at the luncheon given by the Chicago Chamber of Commerce to its frolicsome finish at the "feast of Jupiter" practically every hour was occupied by some part of the business or the entertainment program. At the four business sessions six speakers, leaders in their respective branches of the industry, addressed the delegates.

The jollification reached its zenith at the "feast of Jupiter," which, by the way, is something new in Jovian entertainment. For this elaborate affair the entire parlor floor of the Sherman Hotel was reserved. Each room was decorated, provided and provisioned with the ornaments, the entertainers and the food and drink of a different country. In the Turkish room were fruits, coffee and cigarettes, and a sword swallower from the Far East. In another room were the pork and beans of old-plantation times and entertainers of a dusky hue. In the rooms labeled "Alt Nuremberg," "Banzai Nippon" and "Bohemia" were to be found attractions such as are suggested by the names. Thirteen orchestras and 300 professional entertainers kept things moving to a lively tune in every realm portrayed. There were no lulls in the merriment from the time the feast opened at 6.30 p. m. until the carnival closed at 11 p. m.

H. E. NIESZ, RETIRING JUPITER

In the degree-team competition St. Louis defeated Chicago and carried away both the team and the individual prizes. Following this event the annual rejuvenation was conducted by the Chicago team, bringing into the order 323 candidates, the largest class ever initiated.

The Industry Needs Commercial Scientists

Interspersed with the typical Jovian good times were the more serious activities of the commercial division. At one of these meetings E. W. Lloyd of Chicago, president of the N. E. L. A., speaking on "Extending the Utilization of Electrical Energy," declared that one of the industry's greatest needs at present is practical men with a thorough knowledge of electrochemistry and electrometallurgy. Such men to-day are scarce. Mr. Lloyd also predicted rapid growth of central-station electric-heating loads and urged the manufacturers and jobbers not to fail to co-operate with central stations in their attempt to popularize electrical appliances.

F. M. Feiker of New York, editor of the ELECTRICAL WORLD, in a paper entitled "An Industry Plus," told of the wonderful strides made by the electrical business since its entrance into the commercial world forty years ago. The facts that the industry is founded on science and that the men of the industry are imbued with that crusader spirit which makes each "once an electrical man always an electrical man" is responsible, he said, for the industry's rapid and healthy growth. Looking into the future, Mr. Feiker predicted that the leaders of the electrical industry of to-morrow will be men in whom are combined the attributes of the modern business man and the man of the scientific turn of mind.

In the absence of Henry L. Doherty, president of the Society of Electrical Development, A. A. Gray of Chicago, managing editor of the *Electrical Review and Western Electrician*, outlined the Prosperity Week plans of the Society for Electrical Development.

The Electric Vehicle as a Stimulator of the Industry

John F. Gilchrist of Chicago, president of the Electric Vehicle Association, in order to show what a great stimulus to business the sale of electric vehicles could be made, pointed out the fact that while about $400,000 worth of electrical energy is now sold annually for propelling vehicles in Chicago, about $22,000,000 worth could be sold if all vehicles were electric. One reason the electric-vehicle industry does not advance more rapidly, concluded Mr. Gilchrist, is because men vitally interested in the electrical business exploit the electric vocally but themselves ride in gasoline cars.

Speaking on "The Public Utility as a Factor in the Development of a City," H. M. Byllesby of Chicago said that the regulation situation has come to its present condition because the average man has not concerned himself with the provisions of the laws under which State utility commissions operate. "As a voter, the average man—the man such as I see in this audience," he concluded, "should see that these laws are made fair."

An abstract of the address on "The Relation of the Jobber to the Electrical Industry" by W. R. Herstein, president of the Electrical Supply Company of Memphis, Tenn., has been held, for lack of space, for a later issue.

Election of Officers

Officers for the ensuing year were elected as follows: Jupiter, Thomas A. Wynne, vice-president Indianapolis (Ind.) Light & Heat Company; Mercury, Ell C. Bennett, St. Louis, Mo.; congressmen, Dan. G. Fisher, Dallas, Tex.; John F. Killeen, Pittsfield, Mass.; James H. Betts, New York City; Henry Harris, Pittsburgh, Pa.; M. H. Moffett, Cleveland, Ohio; J. F. Ramier, Memphis, Tenn.; C. S. Barnes, New Orleans, La.; H. Root Palmer, Richmond, Va.; Frank D. Beardslee, St. Louis, Mo.; W. R. Patton, Milwaukee, Wis.; H. J. Gille, Seattle, Wash.; John J. Cooper, Denver, Col.; J. Harry Pieper, Los Angeles, Cal.; John F. Ward, Toronto, Ont.; F. E. Filer, Winnipeg, Manitoba.

Midwinter Convention Proposed for I. E. S.

A meeting of the council of the Illuminating Engineering Society was held Oct. 14 in the general offices of the society in New York.

After considering the appointments to various committees for the present year, preliminary plans were discussed by Dr. Steinmetz for the holding of a semi-annual convention in New York next February to mark the tenth anniversary of the organization of the society.

It was also planned to arrange for the presentation of a course of lectures on illuminating engineering similar to the course which was given in the fall of 1910 at Johns Hopkins University.

Meeting of Executive Committee of the National Electric Light Association

The executive committee of the National Electric Light Association met at the association headquarters in New York on Oct. 8. Many important problems confronting the electric-lighting industry were taken up for discussion, including the National Electric Safety Code, affiliation for co-operative work with other national and State bodies, taxation of public utilities, and the selection of the next convention city.

National Safety Code

As chairman of the committee appointed to confer with the Bureau of Standards, W. H. Blood, Jr., of Boston, reported that his committee and the representatives of the American Electric Railway Association, the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies, the Electrical Manufacturers' Club and the Commercial Section committee on wiring had met Dr. Rosa of the Bureau of Standards to go over the tentative rules prepared by the bureau. At this meeting it was found that the changes and criticisms suggested could not all be formulated by Oct. 27, the date fixed by the Bureau of Standards for its conference in Washington, and the several associations interested petitioned the Bureau of Standards requesting a postponement of the conference. As already noted in these columns, the Bureau of Standards has agreed to the postponement, although Dr. Rosa will meet various committees in the A. I. E. E. headquarters in New York City during the week beginning Oct. 25. Mr. Blood stated that his committee intended to appoint forty-eight members, many of whom would be specialists in their line, to act as an advisory board available for consultation by the committee.

Association Membership

President E. W. Lloyd announced the appointment of L. D. Gibbs of Boston as chairman of the geographic section committee, the other members of which are the chairmen of the other sections.

The membership of the association as of Sept. 30, as reported by Secretary T. C. Martin, was as follows: Class A, 1144; Class B, 10,776; Class C, 98; Class D, 225; Class E, 825; foreign, 42; total, 13,110.

Applications for membership were received as follows: Class A, 10; Class B, 101; Class D, 3, and Class E, 17, making a total of 131 new members. In addition, one Class C and one foreign member were elected.

In considering the choice of the next convention city four cities were considered—New York, Pittsburgh, Chicago and Atlantic City. R. S. Orr of Pittsburgh made a plea for that city and felt sure that he could guarantee from 2000 to 2400 rooms during the convention week. Walter Neumuller and H. H. Scott, after consulting with the exhibition committee, expressed themselves in favor of Atlantic City, but did not object to Pittsburgh if adequate exhibition space could be obtained. The question of the next convention city was left entirely in the hands of President Lloyd with power.

Technical Section Formed

Past-president H. H. Scott presented applications from eleven Class A members requesting the formation of a technical section. H. M. Edwards spoke of the advantages of a section over a committee in that it appointed officers and committees and was entitled to representation on the executive committee. It was then voted to authorize the formation of a technical section. The officers of this section will be appointed by the president, and the constitution will be drafted by the committee on constitution and by-laws.

Standing Committees

With possibly one or two exceptions, all of the standing committees have now been appointed. The list with chairmen is as follows: Finance committee, J. B. McCall, Philadelphia; public policy, W. W. Freeman, Cincinnati; rate research, Alex Dow, Detroit; accident-prevention, M. J. Insull, Chicago; educational—honorary branch, J. F. Gilchrist; representing N. E. L. A., H. L. Doherty, New York, and representing the colleges, Prof. M. C. Beebe, Madison, Wis.; company sections, F. J. Arnold, Chicago; membership, George Williams, New York; overhead line and inductive interference, R. J. McClelland, New York; prime movers, I. E. Moultrop, Boston; electrical apparatus, L. L. Elden, Boston; lamps, F. W. Smith, New York; meters, C. G. Durfee, Rochester; underground construction and electrolysis, E. B. Meyer, Newark; grounding secondaries, P. Spencer, Philadelphia; electrical measurements, values and terminology, Dr. A. E. Kennelly, Cambridge, Mass.; question box, S. A. Sewall, New York; Doherty and Williams prizes, P. Lüpke, Newark; Frasse prizes, E. W. Lloyd, Chicago; progress, T. C. Martin, New York; constitution, R. S. Orr, Pittsburgh; street lighting, S. B. Way, Milwaukee, Wis.; geographic section, L. D. Gibbs, Boston.

President Lloyd announced the appointment of Samuel Insull of Chicago and C. L. Edgar of Boston as the committee to represent the National Electric Light Association at the exercises commemorating Edison Day at the Panama-Pacific International Exposition in San Francisco.

Reports were made by H. M. Edwards and J. Becker, chairmen respectively of the Accounting and Commercial Sections, and Secretary Martin told of the co-operative work of various committees of the National Electric Light Association with other national bodies.

Activities of Associated Manufacturers of Electrical Supplies

A meeting of the lamp receptacle and socket section of the Associated Manufacturers of Electrical Supplies was held at the Biltmore Hotel, New York City, on Oct. 6. The following sub-committees were appointed by B. E. Salisbury, chairman of the section:

Key and Pull-Socket Committee—G. W. Goodridge, chairman, Perkins Electric Switch Manufacturing Company; J. C. Dallam, General Electric Company; C. P. La Shelle, W. R. Ostrander & Company; H. W. Bliven, Harvey Hubbell, Inc.; F. H. Chapman, Yost Electric Manufacturing Company.

Sign Receptacle Committee—H. T. Paiste, chairman, H. T. Paiste Company; G. E. Maguire, E. H. Freeman Electric Company; E. R. Grier, Arrow Electric Company; J. W. Mackenzie, Union Electric Company; H. J. Morey, Pass & Seymour, Inc.

Miscellaneous Receptacle Committee—A. H. Fleet, chairman, Cutler-Hammer Manufacturing Company; C. H. Bissell, Crouse-Hinds Company; Charles Wirt, Wirt Company; J. Weber, Weber Electric Company.

A line of suggestions for bettering the product, and in connection with the Underwriters' Laboratories, was submitted to the committees to be reported upon at later meetings.

The Rubber-Covered Wire Industry Conference met at the Hotel Manhattan, New York, on Oct. 13 and voted to disband. The members will join the wire and cable section of the Associated Manufacturers of Electrical Supplies. The dinner was attended by twenty-eight members of the Rubber-Covered Wire Industry Conference, which has promoted the work of standardization during a long career.

Tendencies in Central-Station Rate-Making

An Authorized Interview with W. W. Freeman, President of the Union Gas & Electric Company of Cincinnati, Ohio

BY FREDERIC NICHOLAS

The tendency of electric rates has been downward for so long a period that reductions have lost their novelty. Public and companies have accepted them as a matter of course. But in some companies which have been especially zealous in lowering rates the question is being raised: How long can the process continue? This point formed the beginning of a discussion by W. W. Freeman, president of the Union Gas & Electric Company of Cincinnati, with a representative of the ELECTRICAL WORLD. In his office in Cincinnati Mr. Freeman went over the principles involved in the pending rate case of his company, one of the most important cases of this kind now unsettled. Necessarily the discussion went farther than the local issues at stake and touched broad problems of public policy, which the position of Mr. Freeman as chairman of the public policy committee of the National Electric Light Association emphasizes.

"IT is no longer prudent to assume that enough increase in business will follow decreases in rates to assure a profit," declared Mr. Freeman. "The developments of the past, the progress of the art make caution advisable. I would go so far as to say that in many cities increases in maximum rates could be justified far more plainly from an accounting standpoint than the decreases which are so widely advertised. With most companies maximum rates are below the figures representing actual cost of service for consumers served at those rates."

"Your statement, Mr. Freeman, is that the strictly maximum-rate consumers in practically every community are served below cost. Why is this done?"

"I regard the maximum-rate business as in the nature of a tax on the electric company," was the reply. "Certainly it has not the element of profit which is naturally expected in an ordinary business transaction. Prorate costs according to output, disregarding power business, and you will find that lighting rates would have to be very much higher. Rates for a large percentage of the business representing the largest percentage of the output are necessarily somewhat complex. Rate-making is not exactly discretionary with the company, as it must be so directed as to facilitate getting the business. No regulation or outside contingency can have any practical effect on power rates. The tendency to make residence rates below a figure representing actual cost and a reasonable profit has its origin in the desire of companies for popular support. As a matter of fact, a higher maximum rate with some companies, with a corresponding increase in quality of service, would be distinctly in the interest of both consumer and company."

In this connection Mr. Freeman brought out the other point that increased residence business may be more than offset by still greater economies in energy consumption by lamps and appliances of all kinds.

W. W. FREEMAN

"These conditions and the probabilities vary materially in different communities," added the past-president of the N. E. L. A. "There is a very great likelihood, however, that they may prove to be true in the case of properties situated in cities whose increase in population is small. In cities of rapid growth the opportunities for increased load are very much enhanced. One of the principal difficulties in the Cincinnati situation is the public inclination to assume that conditions are the same as in Detroit and Cleveland, for instance, where the growth in the last decade has been phenomenal. The facts are that from 1900 to 1910 Cincinnati increased in population 12 per cent, Detroit 60 per cent, and Cleveland 46 per cent.

"The demagogue or thoughtless person says that if rates in Cincinnati were reduced arbitrarily a development in business would follow that would produce a satisfactory revenue at the lower rates; but they wholly fail to realize that increase in business in the other cities with which we are compared is due to a considerable extent to increase in population, a factor which is negligible in Cincinnati."

"Why is it only the maximum rate which is the basis of contention between your company and the city?" the interviewer asked of Mr. Freeman.

"The maximum rate is emphasized in Cincinnati," was the answer, "because of a persistent attempt on the part of some newspapers and individuals to lay undue stress on points which they regard as most prominently unfavorable to the company and as affording the strongest ground for attack and for incitement of public clamor. The percentage of the business in any city that yields the maximum rate is so small that the total amount of revenue concerned is of relatively small importance as compared with the operations of the company as a whole. Whatever it is, however, it should be conducted, like other operations of the company, on a reasonable business basis."

So much has been said about the cost and the wisdom of valuation that Mr. Freeman was asked for his opinion on these points and their bearing on the Cincinnati maximum-rate case.

Expense to Company is $100,000

"Our estimate," he said, "is that the expense to our company of our rate adjustment, including the elaborate appraisal and other incidental outlays, will be approximately $100,000. The city of Cincinnati will probably spend an additional $25,000, of which more than one-half has been used now. The Public Utilities Commission will probably spend outright a corresponding sum without including any allowance for salaries of the members or regular staff of the commission. I feel that the valuation is an extraordinary and inefficient method of reaching a final decision, but in the present temper of the public mind in Cincinnati it is probably the only way that would prove to be reasonably satisfactory to all concerned.

"The wisdom of appraisals made by and for a company without any public requirement therefore depends, in my opinion, upon the individual circumstances in each case. For a company to make an appraisal with the necessary large expenditure entailed merely in order to gratify curiosity is unjustifiable. It is far better to save the money and do the work only when it is required for some special purpose. The force of this position is shown by the fact that an appraisal made voluntarily by a company would not be accepted by any judicial body without verification and modification to bring it up to date, which would mean an additional expenditure of time and money amounting to a considerable portion of the original expense. Of course in some cases it is absolutely necessary to make appraisals, while in others, although not necessary, it is advisable."

In this connection reference was made to the 1915 report of the public policy committee of the N. E. L. A., which pointed out that several rate cases had been decided by commissions without valuations. Commenting on this point, Mr. Freeman said:

"If there exist on the part of the intelligent public, as probably was the case in Cincinnati, a sincere doubt as to the reasonable basis for the capitalization of the company in order that its earning power may be limited to a reasonable extent, it will be to the ultimate advantage of the company, notwithstanding the delay involved, to have a reliable determination of facts to clear away the doubt. In our case we believe that the procedure which has been followed will be for the ultimate benefit of the company in establishing beyond any question the quality of service and the reasonableness of rates."

"What other method do you favor or would you recommend not only for your case but for other companies which may have similar problems?"

Let the Business Men Decide

"I said two years ago and am glad to repeat," replied Mr. Freeman, "that if the question of rates could be taken up and disposed of on a business basis by a committee of business men representing the city it would be adjusted speedily and satisfactorily and there would be no effort, on the one hand, to ascertain the last penny that could be ground out of the company without legal confiscation of its property or, on the other hand, to make the highest rates that could be fixed without risk of public disfavor. Such a method of negotiation would have permitted, and if applied in other cases will permit, the time and energy of the company personnel to be devoted to the development of the business and the service of the public with the greatest advantage to all concerned.

"It is true that such an arrangement might seem impracticable under Ohio laws, which give the rate-making power to the city councils, subject to review by appeal to the Public Utilities Commission. Rate-making by the highly political city councils means that rate-making becomes a political matter."

The conversation was shifted then to the local situation in Cincinnati. An ordinance governing the maximum electric rate expired on March 1, 1914. The company asked a renewal on the same terms for a second period of ten years. An ordinance was passed by the City Council, however, which provided for a maximum rate of 8½ cents. The Council had authority to act without a valuation. When the company appealed to the State Public Utilities Commission that body was required under the law to make an appraisal. The entire situation is therefore now in the hands of the State commission. Replying to questions, Mr. Freeman amplified some of the points, stating:

"When the franchise negotiations became a political issue all sorts of claims, many grotesque and entirely false, were advanced in regard to the company by those who are opposing it. One assertion which was made repeatedly was to the effect that the company was overcapitalized and sought high rates in order to obtain a high return on the actual property concerned. In view of the politics of the situation and the persistent claims advanced on all sides it was probably necessary that all the facts bearing on the case should be determined accurately and judicially.

Some of the Questions Upon Which Mr. Freeman Expresses His Point of View

How long can the rate-lowering process continue?

Why do you retain maximum rates which you find unprofitable?

Should no valuation be made except when it is necessary?

What method of settling rate cases do you recommend?

What is the effect of rate litigation on employees and on the business?

Are Western and Eastern public policy conditions essentially different?

Prompt Settlement Will Hasten Construction

"From the beginning we offered the city and the commission the freest access to all of our records. We freely offered all information desired to any agency properly interested. We urged as prompt a settlement as could be made to produce a practical and permanently satisfactory conclusion, with the idea that the avoidance of unnecessary delay would hasten the construction of a new electric generating station and promote the general development of the property in the public interest. In all respects we were entirely willing to follow whatever procedure seemed to be necessary to permit an equitable and just settlement.

"We feel that our relations with the public are progressing favorably. As the ascertainment of facts is still in progress by the State commission and no actual settlement can be made until that is finished, we base our belief in better public relations on individual expressions in the community and on other evidences of increasing confidence on the part of our customers and the State commission in the integrity and efficient operation of the company.

"Outside of the desirability of removing an element of friction in the community, an equitable settlement is highly important both to the city and the company because upon its consummation a large capital investment depends. We are making arrangements for an ultimate expenditure of $15,000,000 on capital improvements, divided between the electric and the gas property. For a new generating station an immediate expenditure of $5,000,000 is planned. The construction of a new plant on the Ohio River is made imperative by the decision of the city to abandon the canal which is the source of water supply for our present generating station. If our franchise issue reaches a satisfactory conclusion, we hope to be in a position in the next few months to begin active work on our large construction program."

Employees Are Earnest and Loyal

Touching on the effect of the rate case on the employees and on the business generally, Mr. Freeman said in answer to questions on these points:

"The uncertainty about the franchise situation has improved conditions within the organization. It has given the employees an excellent opportunity to become better informed as to the condition of the company. Through the N. E. L. A. company section they have exhibited their very active and enthusiastic purpose of defending the company and of explaining its standpoint to the public. In every way they have shown earnestness and loyalty in the interest of the Union Gas & Electric Company.

"The rate case has had, however, one adverse effect. Agitation has retarded the natural growth of the business. When people are told in the newspapers every day that they are paying the electric company too much it is only natural that there should be a tendency to curtail. Those who had thought of installing service have deferred a decision until the rate case should progress to a settlement. Furthermore, because of the necessary application of the time and thought of officials to the rate case, the company has not been so active and aggressive in soliciting new business as it would be under normal conditions. On account of the large sum which had to be spent on the conduct of this case the company has had to economize on its other expenditures, including those for commercial upbuilding and the development of new business."

The West and the East

In view of the long experience of Mr. Freeman as vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn and his familiarity with the Eastern viewpoint, the interviewer asked him whether he had found conditions of a public policy nature in the West essentially different from those in the East, and also whether they had suggested any ideas which it might be profitable for Eastern operators to know. This was his reply:

"Cities of Ohio are somewhat different from those in the East. In recent years they have heard a great deal of socialism as the result of agitation by some of the newspapers and certain politicians, and with the large laboring population in such cities there has doubtless been created a somewhat stronger socialistic sentiment than is found in Eastern States. Municipal ownership, which is agitated in some of the cities, is only one phase of this socialistic propaganda and is advocated largely as a matter of abstract theory, supported by the claims of success in certain cities. So far as my observation goes, there is nothing affecting the public policy of Western companies that is not appreciated in the East. I think that each community and each State has to meet and solve its own local problems."

Wisconsin Commission to Adopt Standards of Electrical Construction and Operation

Proposed rules for the standardization of electrical construction and operation have been issued by the Wisconsin Railroad Commission, and a public hearing will be held before the Industrial Commission of Wisconsin and the Railroad Commission of Wisconsin in the State Capitol, Madison, Oct. 22. Prior to that hearing there will be one on the standards of electric-railway construction, based primarily on the rules of the American Electric Railway Association.

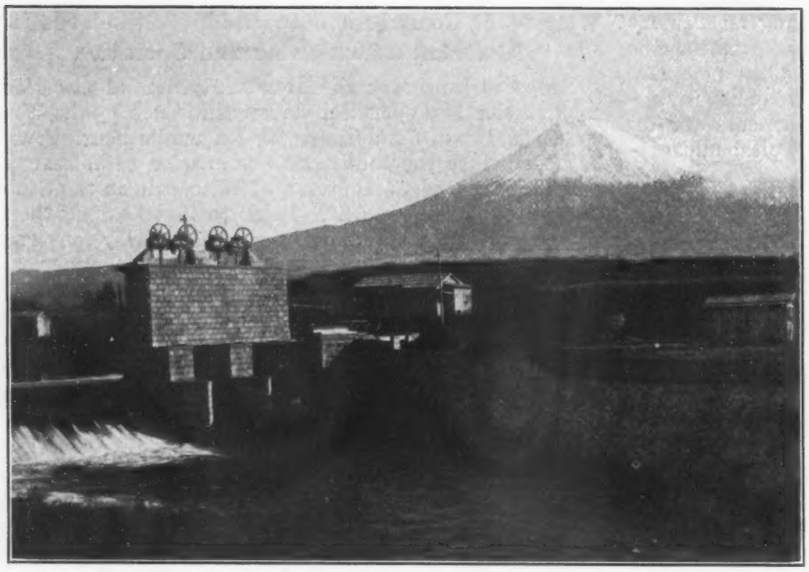
The 1915 Legislature enacted a new law empowering the Railroad Commission of Wisconsin to make and enforce reasonable rules and standards, and to require changes in electrical construction and operation whenever necessary for public safety or to avoid service interference. The Industrial Commission of Wisconsin held a public hearing on March 13, 1914, in the Capitol at Madison, at which time a proposed electrical safety code prepared by a committee of electrical men was discussed. These recommendations covered the installing and operation of electrical equipment, including safe clearances, the labeling and safeguarding of dangerous electrical equipment, the testing and furnishing of safety appliances, and a proposed set of operating rules covering various classes of electrical employees. After the hearing the committee was enlarged to include representatives of the telephone and telegraph interests, and substantial work was continued in the light of suggestions and criticisms made at the public hearing. Learning of the work being done by the Bureau of Standards, the committee temporarily discontinued its meeting, pending the final recommendations from the Bureau of Standards.

Plan to Issue Joint Order

In order that one joint order might be formulated covering all the requirements of electrical construction and operation to safeguard electrical employees, consumers and the general public and to avoid service interference, the two commissions have agreed to hear jointly the arguments, suggestions and criticisms of the recommendations and to issue a joint order in the matter. It is the expectation of the commission that the various groups and associations of parties concerned will present constructive criticism through a committee or individual representing the respective group or association.

The portion of the regulations dealing with interference comprises the principal recommendations embodied in the report adopted by the Railroad Commission of the State of California. The rules of safety for electrical practice and standards for safe and satisfactory construction and spacing are based on the proposed code of safety rules for electrical practice issued by the National Bureau of Standards. These have been regrouped to a considerable extent in order that they might be sufficiently brief to be covered in a public hearing.

According to Chairman Halford Erickson of the commission, the hearing will, from an engineering and practical standpoint, be one of the most important to be held by the commission. It involves the service of power-transmission companies, telephone and telegraph companies, electric-railway and electric-light companies, and also steam-railroad companies. The regulations affect the quality of service of these various companies, their rates for service, and the questions of safety. Railroad Commissioner Walter Alexander and Industrial Commissioner J. D. Beck will represent their respective commissions later at the hearing in Washinging, D. C., which is to be held by the Bureau of Standards.



MOUNT FUJIYAMA AND INTAKE DAM OF KATSURAGAWA SYSTEM

The plant of the Katsuragawa Hydroelectric Power Company utilizes the flow of the Katsura River, a stream fed in part by the melting of the perpetual snows of Fujiyama, the great sacred mountain of Japan. The river has its origin in the so-called lake region of Fuji, where, at an altitude of 3000 ft., the aggregate water surface amounts to about 5000 acres, with a depth varying from 80 ft. to 400 ft. The Katsura River owes its constant rate of flow in particular, however, to the ever-abundant Lake Yamanaka, with its perpetual supply of clear water from subterranean springs. At the point of intake of the hydroelectric company the aggregate drainage area is estimated at about 137,500 square miles. The amount of rainfall in this vicinity averages from 6 ft. to 8 ft. per year, of which evaporation removes from 20 to 25 per cent. The Katsura River ordinarily is characterized neither by floods nor by droughts in the dry season, and an average minimum of from 500 cu. ft. to 600 cu. ft. of water per second is continuously available. By means of a canal 3.068 miles long from its intake to the discharge flume, the power company has secured an effective head of 470 ft. At the intake a gravity-type dam of rough stone and concrete-filled construction, measuring 68 ft. long, 24½ ft. wide at the bottom, and 6 ft. wide at the top, 16 ft. in height above ground, raises the natural water level by about 8 ft. At the end of the overflow there is a sand-drainage gate, measuring 6 ft. by 9½ ft. and designed to discharge sand deposited along the overflow. The second intake, with its flow-regulating gates protected by a fine

Hydroelectric Power from Snowclad Fujiyama

The 28,000-Kva. Plant of the Katsuragawa Hydroelectric Company, Japan, Serving Tokio Over a 53-Mile, 77,000-Volt Transmission Line

By C. Tsukamoto

TOKIO, the capital city of Japan, with a population larger than that of Chicago, is served with electric energy by a number of transmission systems, one of the most interesting of the number being the development of the Katsuragawa Hydroelectric Company, which utilizes the flow of the Katsura River, a stream fed in part by the melting of the perpetual snows on Fujiyama, the famous peak of the Island Empire.

Throughout the design of the Katsuragawa system simplicity has been everywhere adhered to so far as consistent with the reliability and safety of service. Double-bus systems and the promiscuous use of automatic relays, for example, were avoided. The absence of butterfly valves, sluicegates, air pipes, etc., the piping arrangement for exciter units, and the use of double-spiral turbines instead of twin-wheel turbines, give an idea of the simplicity striven for. As a result, the initial cost of the system was cut down to the remarkably low figure of about $100 per horsepower installed, notwithstanding the fact that first-class hydraulic as well as electrical equipment was employed. This cost includes the outlay for the waterway, power house, transmission system and two substations. The waterway required about 32 per cent, the power plant 22 per cent, the transmission line 18 per cent, and the substation 12 per cent of the total construction expense. The remaining 16 per cent or so was spent for engineering, supervising, etc. Two flood seasons have now been passed with no serious trouble.

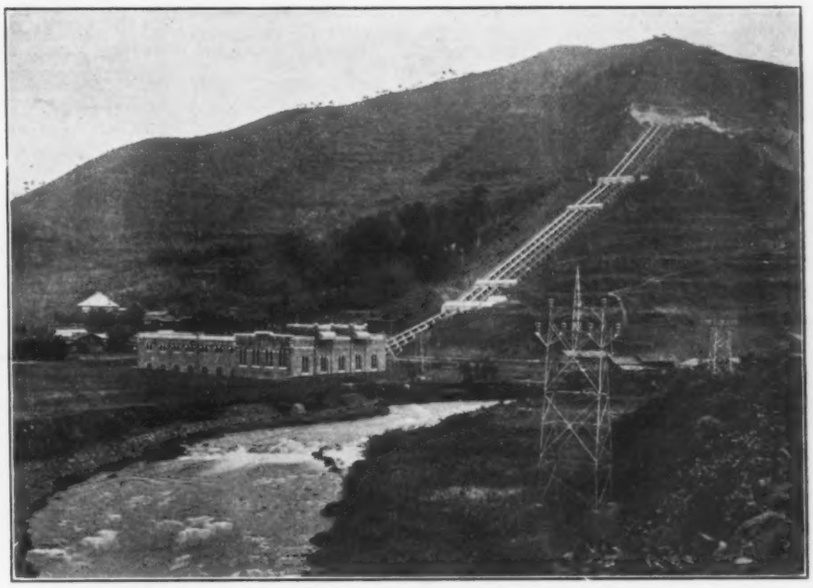
Four waterwheels designed for an effective hydraulic head of 470 ft. are installed. They are of the Francis double-spiral horizontal type built by E. M. Voith & Company of Germany and are capable of developing 8000 hp. each at three-quarters gate opening and 10,000 hp. each at full gate opening. The guaranteed efficiency at three-quarters gate opening was 82 per cent, but the test results have indicated about 84 per cent. The governor oil, which is a mixture of seven parts dynamo oil and one part cylinder oil, is maintained at a pressure of 25 atmospheres by the operation of a rotary pump.

To the waterwheels just referred to are connected three-phase, fifty-cycle, 11,000-volt alternators with a normal rating of 7000 kva. each at 80 per cent power-factor. These machines were built by the General Electric Company, Schenectady, N. Y. The rated load of one unit can be carried at three-quarters gate opening, when the waterwheel will operate at its best efficiency. With full gate opening any one of the generators can be overloaded by 25 per cent. One of these four units is to be kept as a reserve, in accordance with the government regulation specifying 20 per cent of the station rating for reservation. The exciters are driven by horizontal Pelton impulse waterwheels rated at 300 hp. each.

The 11,000-volt output of the generators is stepped up to the transmission pressure of 77,000 volts by three banks of oil-immersed, water-cooled transformers, each bank consisting of three single-phase 3500-kva. General Electric units. One of these banks of transformers is held in reserve. The main building housing the generating equipment and an auxiliary structure containing the transformers and high-voltage switchboard were arranged in the shape of a T so that the transformer high-tension leads could be installed directly in line with the outgoing transmission system, thus avoiding any bends at the outlets from the station. The outgoing lines pass through the center of glass plates set in 8-in. openings in the wall. The outlets are protected by projecting hoods.

On the second floor overlooking the generating room is a remote-control benchboard-type switchboard. A single-bus system sectionalized at the middle is employed. The generator oil switches are operated by motors and equipped with inverse-time-limit overload relays as local conditions seem to warrant them. The 77,000-volt oil switches on the high-tension side of the transformer are also provided with inverse-time-limit relays, but are operated by solenoid mechanisms. Two sets of aluminum-cell lightning arresters, each consist-

steel screen laid at a 45 deg. angle, is situated further down from the sand drainage and is so placed that the remainder of the sand will be deposited in the still-water region and thrown away from silt pits. Of the entire length of about 3.1 miles of waterway, approximately 25 per cent is open canal and about 68 per cent is tunnel. The remaining 7 per cent constitutes the discharge flume and tailrace. The open canal is generally about 8½ ft. wide at the bottom, with slanting reinforced-concrete side walls to the height of 9½ ft. Sections of asphaltum felt are inserted every 18 ft. to permit expansion. The tunnel section is also lined with concrete 6 in. to 8 in. thick and is varnished to a thickness of about ½ in. to reduce friction. Two other sand drainages are situated along the canal with large silt pits dug down 4 ft. below the canal bed, from which the silt is discharged through 18-in. cast-iron pipes. The forebay at the end of the canal is 54 ft. by 56 ft. in area, with an actual depth of 18 ft., 7 ft. of which is available. The bulkhead wall to which the pressure pipes are fitted is 11 ft. thick at the bottom and contains a silt pit for the deposition of any remaining sand before the water is led into the pipe lines. The four pressure pipes are of Siemens-Martin mild steel, 10 mm. to 18 mm. in thickness. The total length of each pipe line is about 1350 ft., and its outside diameter is 1720 mm. at the top and 1585 mm. at the bottom. The pipes are muff-jointed, and are provided with no special expansion joints. Relief valves are provided at the lower ends of the pipe lines to care for any abnormal rises in water pressure and for the effects of water hammer.



KATSURAGAWA PLANT, SHOWING PENSTOCKS AND SURGE TANK

ing of four tanks, are connected with the outgoing circuits. On the low-tension side of the bank of step-up transformers are three-phase aluminum-cell static dischargers, which, besides serving the purpose their name indicates, provide a "relief valve" for any high voltage which may accidentally leak into the low-tension side. An electrostatic voltmeter of the Pan type is connected between the high-tension neutral points and one phase of the low-tension side of the transformers, to indicate a shift in the electrical neutral due to unbalanced loads and also to show when there is a possibility of leakage between the high-tension and low-tension windings. To prevent serious disturbances from arcing grounds a suppressing device is employed by means of which the exciter-field resistance is automatically cut in to lower the generator voltage in case of excessive current in the main line.

To make the switch-control system independent of disturbances on the exciter bus and thus insure the reliability of service a storage battery is floated continuously on the control bus in multiple with a charging generator. The storage battery, which is of the Tudor type, consists of sixty-two cells having a rating of 81 amp.-hr. at 125 volts. The charging-generator set consists of a 3.25-kw., 125-volt shunt-wound generator directly connected with a three-phase, 220-volt induction motor, running at 1500 r.p.m. All of the electrical apparatus in the power station and in the substations described later was furnished by the General Electric Company of Schenectady.

Power is transmitted from the generating station to two main substations, both in the vicinity of Tokio. From these receiving stations the energy is further subdivided among five smaller substations, all in towns and villages within 10 miles of the city of Tokio.

The main transmission line, extending from the generating station to the Totsuka substation, a distance slightly over 53 miles, consists of two three-phase, 77,000-volt circuits. These are supported on a single row of double-circuit steel towers, except where spans longer than 550 ft. are required, when single-circuit towers are used. No. 12 B.W.G. eighteen-strand bare-copper cable with hemp core is used in the standard-length spans, whereas silicon-bronze cable of the same size is employed in spans above 550 ft. The conductors in each circuit are arranged 7 ft. apart at the apexes of equilateral triangles whose centers are 14 ft. apart. On the single-circuit towers the conductors are placed 10 ft. apart. Each circuit is designed to carry the entire load when necessary, but under ordinary conditions both circuits are kept energized to prevent complete interruption to service in case one circuit is broken. The conductors are strung to give a tension of 1500 lb. in the copper cables and 1800 lb. in the silicon-bronze cables with a factor of safety 6.7 when they are covered with a 7/16-in. coating of ice and subjected to a wind velocity of 100 m.p.h. at 20 deg. C. The minimum ground clearance is over 20 ft. Extending between the apexes of the towers is a ground wire consisting of No. 3 B. & S. gage solid galvanized-steel wire earthed at every other tower through 1.5-in. gas pipes which are 5 ft. long.

The standard spacing employed for towers on this line is 450 ft., the distance from the ground to the lowest conductor support is 36 ft., the base measurement is 12 ft. by 15 ft., and the weight is 3500 lb. per tower. Since the flat land covered by the transmission line is generally marshy and the hillsides are liable to slide, somewhat shorter spans than usual are employed over these portions of the route and substantial concrete footings are provided for each tower by diagonally joining the tower legs with 5-in. angle irons and burying each leg for a depth of 6 ft. in about 54 cu. ft. of concrete. In some places, such as river beds, etc., concrete piers as deep as 25 ft. or more are provided for the tower foundations. The longest span is 840 ft. Six complete transpositions have been made in each of the main circuits.

Connected with the main line about 5 miles from the Totsuka substation on the generating station side is a branch line which extends to the Rokugo substation, a distance of about 11 miles. This line consists of two three-phase circuits made of No. 9 B.W.G. six-strand copper cables with hemp cores arranged on double-circuit steel towers in the same manner as those on the main line. One complete transposition of conductors is made in this section, and a ground wire is installed 10 ft. above the apexes of the triangles.

Insulators used throughout the transmission system are of porcelain quadruple-petticoat pin type and were manufactured by the Nippon Porcelain Company, Japan. The insulators will withstand 200,000 volts for ten minutes in dry air and 120,000 volts for ten minutes under a shower of water. They have also been subjected to

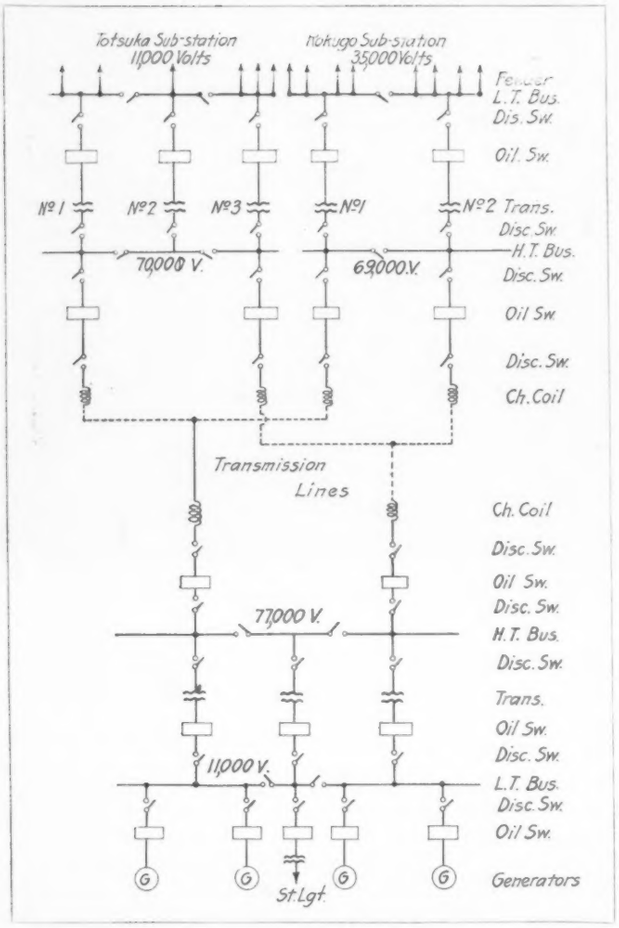


DIAGRAM OF GENERATING, TRANSMISSION AND RECEIVING SYSTEMS

a 5000-lb. vertical and to an 8000-lb. transverse stress.

During the year and a half which the electric-service system has been in operation no serious disturbances have ever been encountered. Occasional trouble is caused by crows perching on the tower arms and grounding the circuits. Snakes have also caused infrequent disturbances. To protect the line each conductor is connected with the earth at each switch house along the line through a horn-gap and a porcelain-tank water resistor. There are five such switch houses wherein the service can be switched over from one circuit to the other when any particular section of the lines must be inspected or repaired. Living in these houses are patrolmen who look after the lines, lightning arresters, etc.

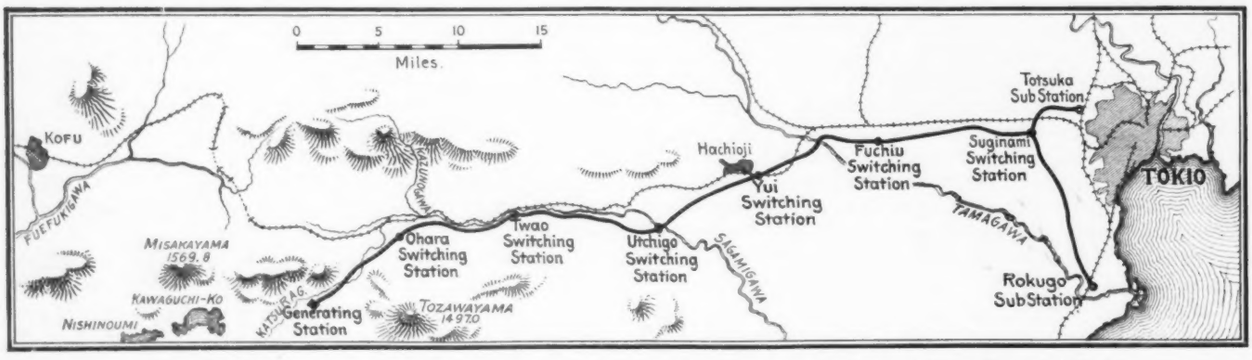
Facilities are provided in the houses for telephoning to the power house and substations. The telephone lines extend along an independent right-of-way, which never approaches closer than 180 ft. to the main power circuit. The telephone circuits, of which there are two, consist of No. 10 B.W.G. hard-drawn bare-copper wire supported on wooden poles. Wherever a span longer than 240 ft. is required, as in river crossings, silicon-bronze wire of the same size is used. These circuits are transposed about every 550 ft.

Two different classes of steel towers are employed on this system. One class is constructed of large structural members to carry the load of the double-circuit three-phase lines and a ground wire used on the main circuit between the generating station and the Totsuka substation. The other class is provided with a lighter structure to carry the double-circuit three-phase line and ground wire used on the branch circuit running to the Rokugo substation. Both classes comprise a variety of intermediate, strain-angle, terminal and switch towers.

Totsuka substation, a two-story brick and concrete structure with a floor space of 6700 sq. ft., is situated on the north side of the city of Tokio. Transformers and machinery are installed on the first floor and the switchboard and arresters on the second. Three banks of three single-phase transformers are installed, each unit being of the water-cooled type, rated at fifty cycles, 2000 kva. and 70,000/11,000 volts. Extra taps are provided on the low-tension side to give 11,400 volts and 10,600 volts when desired. None of the transformer neutrals is grounded. The transformer cooling water is pumped from a well by a motor-driven centrifugal pump rated at 5 hp. and capable of delivering 115 gal. per minute against a head of 35 ft. Three 10-kva., single-phase oil-cooled transformers, two motor-generator sets and a storage battery are provided to furnish energy for station lighting and operation of switchboard auxiliaries. Energy at 11,000 volts is distributed to various secondary substations by underground cables. Except for static dischargers in the low-tension bus no special device is provided for static disturbances.

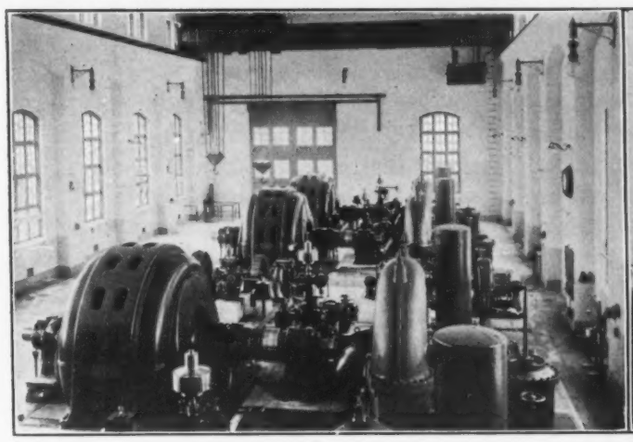
The Rokugo substation, which is in the south side of Tokio, is arranged similarly to the Totsuka substation, but it contains only two banks of three single-phase transformers. The units in these banks are rated at 2000 kva. and step the pressure from 70,000 volts down to 3450 volts. One bank is held in reserve. The neutrals are not grounded in this station either. Station lamps and switchboard auxiliaries are supplied with energy by three 7-kva., 3450/125/230-volt, single-phase oil-cooled transformers, two motor-generator sets and a storage battery. The 3450-volt circuits are protected with multi-gap graded-shunt-type lightning arresters. The transformer cooling water is obtained from a well by a pump set similar to that in the Totsuka substation.

From the two main substations previously mentioned energy is supplied to five distributing stations which

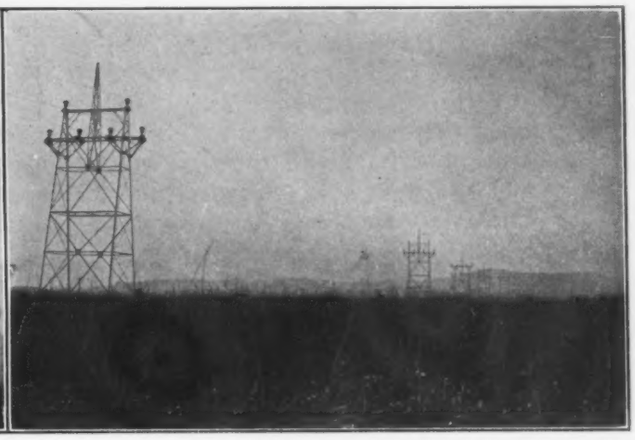


MAP OF 77,000-VOLT SYSTEM OF KATSURAGAWA HYDROELECTRIC COMPANY, SERVING TOKIO

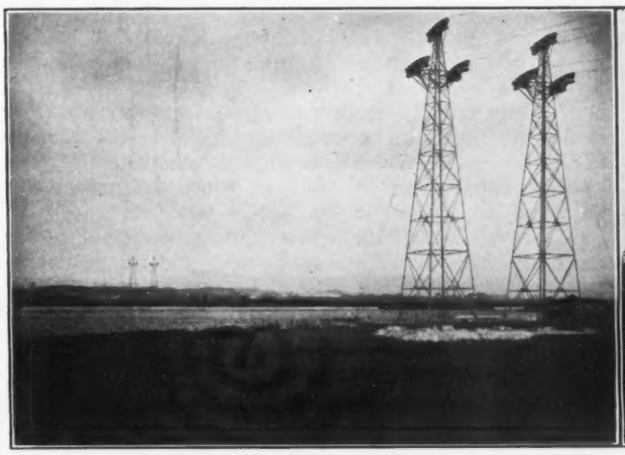
serve lighting, railway and power loads. About 250,000 lighting and motor installations, besides a municipal railway, are being supplied with energy by underground cables at 11,000 volts. The Keihin Traction Company, operating a high-speed system between Tokio and Yokohama, demands about 2500 kw.; the Tokio Electric Company at Kawasaki, which is affiliated with the General Electric Company of the United States, takes about 650 kw., and the Nippon Steel Pipe Company requires about 1800-kw.



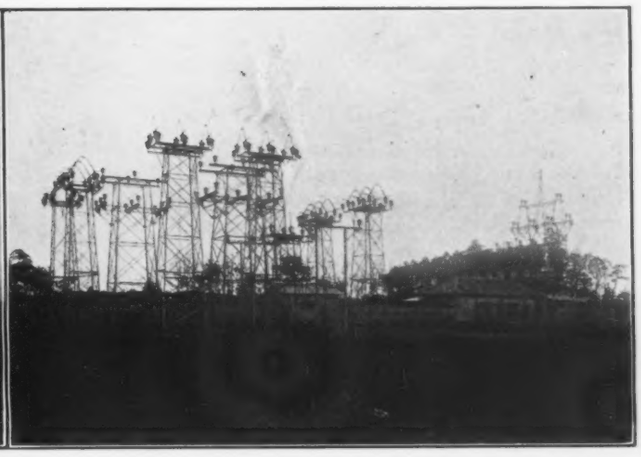
THREE OF THE TURBINE-DRIVEN GENERATORS IN THE SHISHIDOME GENERATING STATION



TYPE OF LINE CONSTRUCTION EMPLOYED ON LEVEL GROUND NEAR HACHIOJI

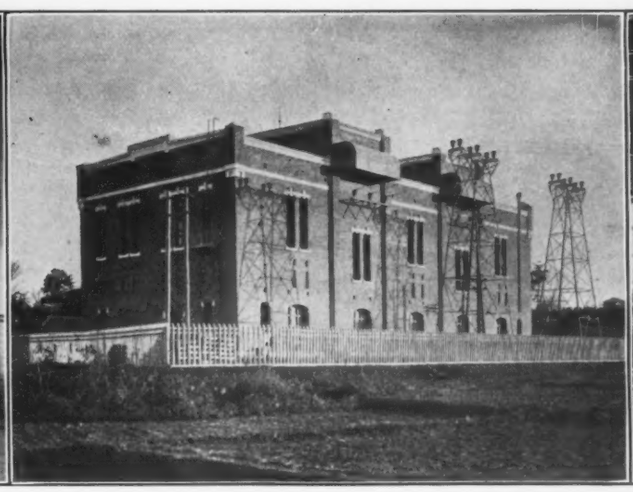


AN 840-FT. SPAN ACROSS THE RIVER ASA SUPPORTED ON MULTIPLE-PIN INSULATORS

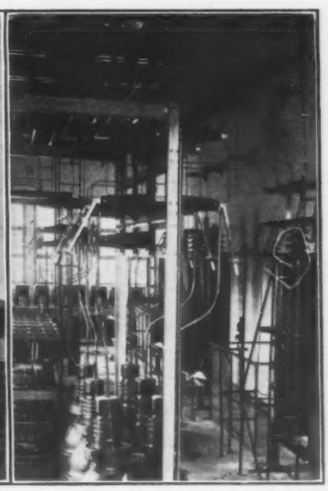


OUTDOOR SWITCHING STATION AT SUGINAMI, WHERE MAIN LINE BRANCHES TO TOTSUKA AND ROKUGO

HIGH-TENSION OIL SWITCHES AND LIGHTNING ARRESTERS AT TOTSUKA



EXTERIOR OF TOTSUKA RECEIVING STATION AND ENTERING TRANSMISSION LINES—SYSTEM OF THE KATSURAGAWA HYDROELECTRIC COMPANY



ALUMINUM-CELL LIGHTNING ARRESTERS AND NEUTRAL RESISTORS

Trigonometric Expressions for the Phenomena Occurring in Long Transmission Lines—II

BY V. KARAPETOFF, PROFESSOR OF ELECTRICAL ENGINEERING, CORNELL UNIVERSITY

In the first part of this article, published last week, the effect of the frequency upon the attenuation constant and upon the velocity of propagation of alternating currents was dealt with, together with a consideration of power dissipation along the line. The article is now concluded by a mathematical treatment of the phenomena of the distortionless telephone line, of voltage rise at the receiver end, and of the quarter-wave-length line.

A LONG telephone line transmits speech without distortion when currents of different frequencies travel along it at the same velocity and are attenuated at the same rate.

3. Distortionless Telephone Line

An inspection of equations (35) and (43) shows that these conditions are fulfilled when

$$\varphi = \psi, \tag{57}$$

because then

$$\alpha = \sqrt{rg} \tag{58}$$

and

$$v = \frac{1}{\sqrt{CL}} \tag{59}$$

So that α and v are independent of f.

Condition (57), when compared with equations (36) and (37), gives

$$\frac{L}{r} = \frac{g}{C} \tag{60}$$

This is the necessary relationship between the line constants in order that the speech be transmitted without distortion.

Some additional insight into the properties of a distortionless line is obtained by considering expressions (27) to (28). When $\varphi = \psi$,

$$\frac{z}{y} = \frac{r}{g} = \frac{x}{b} \tag{61}$$

and

$$r_0 = z_0 = \sqrt{\frac{r}{g}} \tag{62}$$

$$x_0 = 0; \varphi_0 = 0 \tag{63}$$

In other words, a long distortionless line behaves with respect to an initial alternation as if it possessed no inductance or capacity.

Since for a distortionless line $\varphi = \psi$, the inequality (55) becomes an equality, and

$$P_{r,\frac{1}{4}\lambda} = P_{g,\frac{1}{4}\lambda} \tag{64}$$

Thus, in a distortionless line equal amounts of power are dissipated in r and in g for each quarter of a wave-length.[8]

In usual long-distance telephone cables and in aerial lines $\frac{C}{g}$ is greater than $\frac{L}{r}$, and in order to increase this latter ratio Professor Pupin introduces lumped inductance at intervals which are small compared with the wave-length λ. In another more recent construction, due to Krarup, a fine iron wire is wound around the copper conductor, in order to increase its inductance.

[8] A simple discussion of this proposition will be found in Franklin's "Electric Waves," p. 112.

It will be seen that the same end is achieved by reducing r or C, and by increasing g. Of course, the latter method is impracticable because the intensity of the sound would be seriously impaired.

Some interesting conclusions can be drawn from equations (57) to (64), viz.:

(1) In a distortionless line or cable the "series impedance angle" φ is equal to the "shunted admittance angle" ψ.

(2) To make a distortionless line without leakage ($g = 0$) would require an infinitely great inductance L, or zero resistance r.

(3) The velocity of propagation of electric waves in a distortionless line is essentially equal to the velocity of light. This result can be proved by substituting the familiar expressions for the inductance and capacity of an aerial line into equation (46).

(4) In a distortionless line equal amounts of power are dissipated in the line conductors and in the imperfect insulation between the conductors for each quarter wave-length.

4. Voltage Rise at the Receiver End

When a long transmission line is open-circuited at the receiver end, or is only slightly loaded, the receiver voltage E_2 may under circumstances be higher than the generator voltage E_1. The problem is to deduce an expression for the ratio $\frac{E_2}{E_1}$ for a given line and a given load impedance Z_l.

Applying equation (12) to a line of length l gives

$$\dot{E}_1 = \dot{E}_2 \cosh ml + \dot{I}_2 Z_0 \sinh ml,$$

or, dividing both sides by $\dot{E}_2$,

$$\frac{\dot{E}_1}{\dot{E}_2} = \cosh\ ml + \frac{Z_0}{Z_l} \sinh ml, \tag{65}$$

where

$$Z_l = \frac{\dot{E}_2}{\dot{I}_2} \tag{65a}$$

is the equivalent impedance of the connected load.

Since all the quantities which enter into equation (65) are complex quantities, the ratio $\frac{\dot{E}_1}{\dot{E}_2}$ is also a complex quantity of the form $a + jb$. The numerical value of the ratio of the voltages is then

$$\frac{E_2}{E_1} = \frac{1}{\sqrt{a^2 + b^2}} \tag{66}$$

For the benefit of those who are not familiar with complex quantities, or when only tables of functions of real hyperbolic angles are available, the numerical com-

putations may be so arranged as to avoid the use of complex quantities altogether. It is probable that the actual numerical computations are not any longer than when complex hyperbolic quantities are used. The following are well-known relations:

$$\text{Cosh } ml = \cosh(\alpha l + j\beta l) = \cosh \alpha l \cos \beta l + j \sinh \alpha l \sin \beta l \quad (67)$$

$$\text{Sinh } ml = \sinh(\alpha l + j\beta l) = \sinh \alpha l \cos \beta l + j \cosh \alpha l \sin \beta l \quad (68)$$

Let the load impedance Z_l have the absolute value z_l, and the phase angle φ_l, that is, φ_l is the angle between the voltage E_2 and the current I_2.

Then

$$\frac{Z_0}{Z_l} = \frac{z_0}{z_l} \varepsilon^{j(\tau_0 - \phi_l)} = \frac{z_0}{z_l}[\cos \gamma + j \sin \gamma] \quad (69)$$

where

$$\gamma = \tau_0 - \varphi_l \quad (70)$$

Thus the real part of expression (65), which will be denoted by M, is

$$M = \cosh \alpha l \cos \beta l + \frac{z_0}{z_l}(\sinh \alpha l \cos \beta l \cos \gamma - \cosh \alpha l \sin \beta l \sin \gamma), \quad (71)$$

while the coefficient of the imaginary part is

$$N = \sinh \alpha l \sin \beta l + \frac{z_0}{z_l}(\sinh \alpha l \cos \beta l \sin \gamma + \cosh \alpha l \sin \beta l \cos \gamma) \quad (72)$$

Let now the numerical ratio of the voltages E_2 and E_1 be denoted by (VR), meaning "voltage ratio," viz.,

$$(VR) = \frac{E_2}{E_1} \quad (73)$$

and let δ be the phase angle between these voltages. Then

$$\frac{E_1}{E_2} = M + jN = \frac{E_1}{E_2}\varepsilon^{j\delta} = (VR)^{-1}(\cos \delta + j \sin \delta) \quad (74)$$

so that

$$M = (VR)^{-1} \cos \delta; \quad N = (VR)^{-1} \sin \delta,$$

and therefore

$$\tan \delta = \frac{N}{M} \quad (75)$$

and

$$(VR) = \frac{\cos \delta}{M} = \frac{\sin \delta}{N} \quad (76)$$

The computations may be arranged in the following order:

(1) Find angle γ from equation (70);

(2) Compute M and N from equations (71) and (72);

(3) Determine angle δ from equation (75);

(4) Calculate the voltage ratio from equation (76).

The only involved step is the computation of M and N; it may be simplified by factoring out some of the trigonometric quantities and using circular and hyperbolic tangents. When the attenuation αl is small, one may put $\cosh \alpha l = 1$ and $\sinh \alpha l = \alpha l$.

When the line is open-circuited, $z_l = \infty$, and

$$M = \cosh \alpha l \cos \beta l \quad (77)$$

$$N = \sinh \alpha l \sin \beta l \quad (78)$$

It has been proposed to call the voltage ratio in this case the Ferranti ratio or the Ferranti factor.[9] Denoting it by (FR), the square of its reciprocal is

$$(FR)^{-2} = (\sinh \alpha l \sin \beta l)^2 + (\cosh \alpha l \cos \beta l)^2 \quad (79)$$

5. Quarter-Wave-Length Line

Let the length of the line and the applied frequency be such that

$$l = \frac{1}{4}\lambda \quad (80)$$

where λ is the wave-length; see equation (41). In this case

$$\beta l = \left(\frac{2\pi}{\lambda}\right) \cdot \frac{1}{4}\lambda = \frac{1}{2}\pi \quad (81)$$

In other words, the receiver voltage E_2 is in quadrature with the applied voltage E_1. Equations (71) and (72) then reduce to

$$M = -\frac{z_0}{z_l} \cosh \alpha l \sin \gamma \quad (82)$$

$$N = \sinh \alpha l + \frac{z_0}{z_l} \cosh \alpha l \cos \gamma \quad (83)$$

while equations (75) and (76) remain the same as in the general case.

With the line open-circuited at the receiver end equation (79) gives for a quarter-wave-length line the Ferranti ratio

$$(FR)_{\frac{1}{4}\lambda} = \frac{1}{\sinh \alpha l} = \text{cosech } \alpha l \quad (84)$$

In other words, the Ferranti ratio for a quarter-wave-length line is numerically equal to the hyperbolic cosecant of the total attenuation factor αl.

Thus for the experimental line investigated by Kennelly and Pender in the article mentioned above, the attenuation constant $\alpha = 0.000206$ per mile, and the quarter wave-length was 239.5 miles, so that $\alpha l = 0.049337$. For such a small angle the hyperbolic sine is very nearly equal to the angle itself, so that

$$(FR)_{\frac{1}{4}\lambda} = (0.049337)^{-1} = 20.27.$$

The observed value of the voltage ratio was 20.06.

The following expressions for the Ferranti ratio are of interest for numerical computations. Noting that

$$\alpha l = \alpha \cdot \frac{1}{4}\lambda = \alpha \cdot \frac{1}{4} \cdot \frac{2\pi}{\beta} = \frac{1}{2}\pi \cdot \frac{\alpha}{\beta},$$

and substituting for $\frac{\alpha}{\beta}$ its value from equation (28a),

$$\alpha l = \frac{1}{2}\pi \tan \tau \quad (85)$$

Therefore

$$(FR)_{\frac{1}{4}\lambda} = \text{cosech}\left(\frac{1}{2}\pi \tan \tau\right) \quad (86)$$

If tables of hyperbolic functions are not available, the foregoing expression may be expanded into a Maclaurin series, giving

$$(FR)_{\frac{1}{4}\lambda} = \frac{0.6366}{\tan \tau} - 0.2618 \tan \tau + 0.07536 \tan^3 \tau - \text{etc.} \quad (87)$$

The series converges very rapidly, and is convenient for numerical work.

For a line of small resistance and leakage the imperfection angle τ is small, and equation (24) becomes approximately

$$\tan \tau = \cot \frac{1}{2}\varphi + \cot \frac{1}{2}\psi,$$

$$\tan \tau = \frac{1}{2}\left(\frac{r}{2\pi f L} + \frac{g}{2\pi f C}\right)$$

For a small hyperbolic angle the sine is nearly equal to the angle itself, so that equation (86) becomes

$$(FR)_{\frac{1}{4}\lambda} = 8f\left(\frac{r}{L} + \frac{g}{C}\right)^{-1} \quad (88)$$

The Ferranti ratio computed from this formula for the artificial line mentioned above is 20.11, so that the error is well within 1 per cent of the exact ratio.

[9] Kennelly, A. E., and Pender, Harold, "Resonance Tests of Long Transmission Line," ELECTRICAL WORLD, Aug. 8, 1914.

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.

Unit Construction Costs for Hydroelectric System

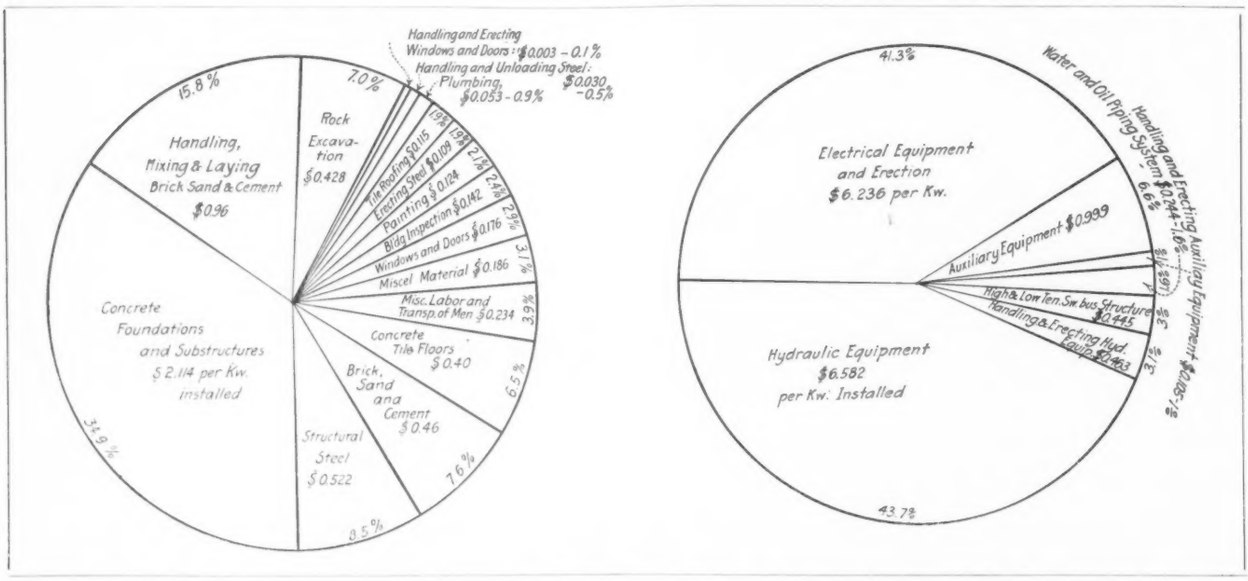
Graphical Presentation of Data to Show Relative Costs of Construction Due to Hydraulic, Station and Transmission-Line Requirements

THE unit cost of constructing a complete electric-service system depends upon local conditions such as nature and location of generating station, character and extent of transmission and distribution lines, contour of land and construction difficulties, cost of labor for the section, transportation facilities, and the like. In what follows a graphical analysis of construction costs is presented which shows the relative magnitudes of the different expenses as well as the unit costs represented by the construction work called for by the Tallulah Falls hydroelectric plant and transmission system of the Georgia Railway & Power Company, which serves large areas in northern and central Georgia. All of the charts are based on data presented at a meeting of the American Institute of Electrical Engineers at Philadelphia, Oct. 11, 1915, by Charles G. Adsit, engineer for the Northern Contracting Company, Atlanta, Ga.

First of all, the total expenses due to constructing each part of the system, including dam, tunnel, power house and lines, are compared. Then each expense is itemized and further compared to show the relative magnitudes of labor, material, transportation and miscellaneous items. As might be expected, these data show that labor is the largest item in constructing each part of the plant. In building the dams the cost of cement, miscellaneous expenditures and cost of quarrying are next in magnitude, representing about 31 per cent of the total expense. The expense of quarrying may be offset by the cost of sheet piling in country where the soil is such that water may seep under the dam. The plant, reinforcement and supervision costs are about equal per cubic yard of concrete laid.

Excavating the tunnel cost about one and a third times as much as lining it, these two expenses constituting about 84 per cent of the total tunnel expense. Labor required about 65 per cent of the total excavating expense, explosives, power and transportation making up 19 per cent more. The cost of cement and crushing stone was a large item in lining the tunnel. It is interesting to point out here that the liability insurance for the entire tunnel construction was slightly over $2 per linear foot, of which $1.52 per foot was for excavating and 45 cents for lining the tunnel.

The cost of constructing the intake, which involved excavating about 7000 cu. yd. of rock and placing 2670 cu. yd. of concrete, consists of $1.517 per cu. yd. for excavating and $9.03 per cu. yd. for concreting. The construction of the surge tank, which was about 113 ft. deep and 2130 sq. ft. in cross-section, required the



FIGS. 1 AND 2—UNIT CONSTRUCTION EXPENSES INVOLVED IN BUILDING AND EQUIPPING THE TALLULAH FALLS (GA.) GENERATING STATION

The construction of the power house was completely described in the ELECTRICAL WORLD, Dec. 20 and 27, 1913. It consists of two main buildings, a generator house and switch house, with concrete substructure and structural-steel framework inclosed with full brick walls as a superstructure. These houses are connected by a small building, forming an H-shaped structure. The approximate volume of the generator building above the generator floor is 385,000 cu. ft., the portion below the floor about 210,000 cu. ft., and the switch house about 1,428,000 cu. ft. To the itemized building-construction expenses graphically represented above should be added $1.178 per kilowatt installed to cover a certain portion of the cost of the temporary compressor plant, spur tracks and general tool and utility equipment. The generator house contains five three-phase, sixty-cycle, 6600-volt vertical generators, rated at 12,000-kva. maximum, directly connected to 17,000-hp. Francis-type water turbines operating under an effective head of 580 ft. at 514 r.p.m.

excavation of about 4750 cu. yd. of rock at a cost of $2.166 per yd. About 700 tons of reinforcing steel was required in the tank and the lower 64 ft. of lining, costing $5.57 per cu. yd.

Construction of the power-house building exclusive of the tailrace cost $6.056 per kilowatt installed. Of this concreting the foundations and substructure required 34.9 per cent. Handling, mixing and laying brick, sand and cement cost 15.8 per cent. Next in magnitude were the costs of structural steel, other building material, rock excavation and tiling floors. Analyzing the equipment expense shows that the cost of furnishing and erecting the hydraulic equipment was about equal to the corresponding expense for the electrical equipment.

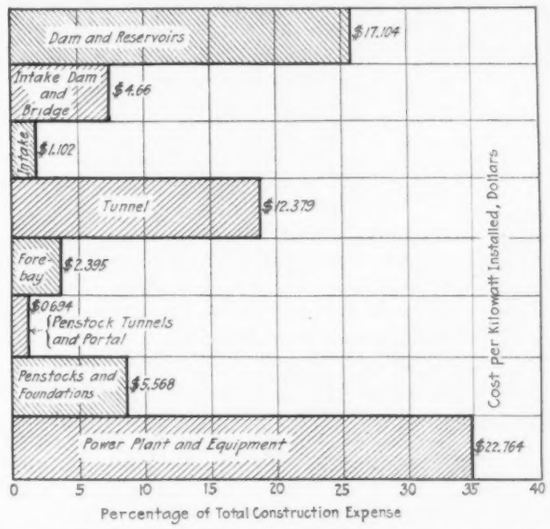


FIG. 3—RELATIVE COSTS OF CONSTRUCTING EACH PART OF THE HYDROELECTRIC PLANT

In constructing the main transmission line the cost of copper was the chief expense, with the costs of tower steel, foundations and right-of-way coming next, in the order named. Branch lines from the Atlanta substation have been built to Lindale (Ga.), 69.2 miles, and Newnan (Ga.), 42.1 miles, at an expense of $4,284.05 per mile and $4,687.90 per mile respectively. Both lines are operated at 110,000 volts and consist of one No. 00 stranded-copper circuit on 70-ft. double-circuit towers. The Newnan line towers also carry a 20-mile, 22,000-volt No. 0000 circuit.

The Boulevard substation at Atlanta, of the outdoor type, is designed for an ultimate capacity of 60,000 kw. All of the equipment for this rating has been installed except 30,000 kw. in transformers and control switches. The costs for this substation and other small substations are shown in Table I.

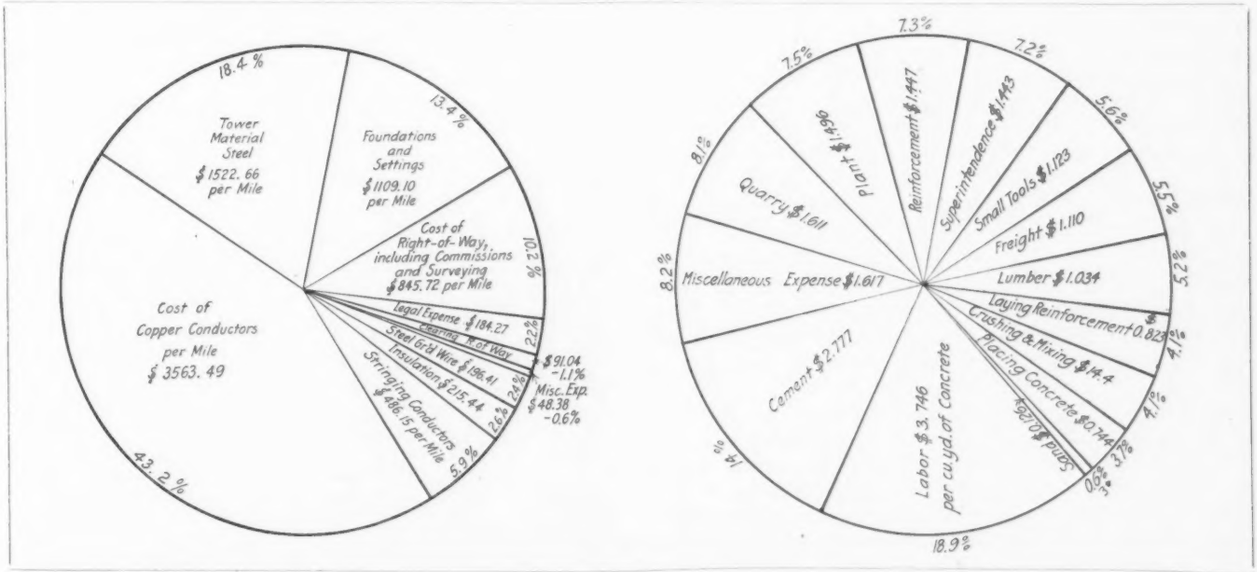
The small substations are almost identical in design

TABLE I—COST OF SUBSTATIONS OF LARGE AND SMALL RATINGS

Item	Cost per Kilowatt	
	Boulevard Substation	Small Substation
Substructure	$0.357	$0.222
Superstructure	0.961	1.942
High-tension steel frames	0.841	1.316
Total electrical equipment	3.783	8.128
Water supply equipment	0.317	.....
Total	$6.259	$11.608

TABLE II—COST PER MILE OF TELEPHONE LINES

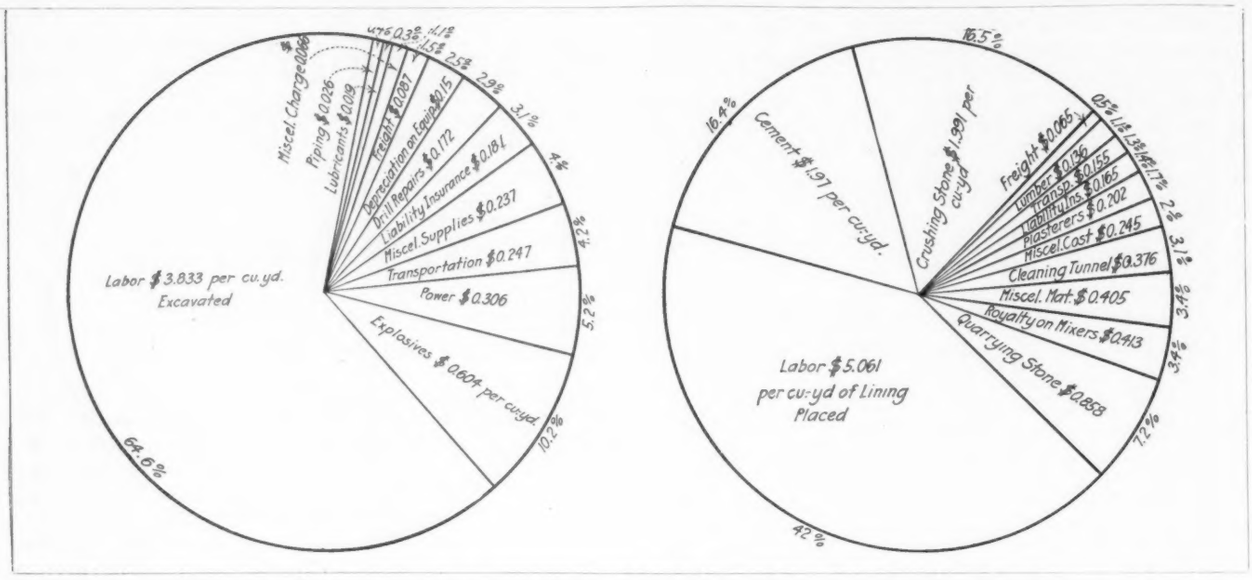
Item	90-Mile Line	69-Mile Line	42-Mile Line
Material	$299.59	$289.84	$370.63
Equipment	91.44	78.55	81.91
Construction	119.89	100.10	103.58
Total	$510.92	$468.49	$556.12



FIGS. 4 AND 5—UNIT COSTS OF CONSTRUCTING THE TALLULAH-ATLANTA TRANSMISSION LINE AND GRAVITY-TYPE DAMS

The Tallulah-Atlanta transmission line consists of two three-phase, 110,000-volt circuits of No. 0000 eight-strand copper cables, which are arranged 9 ft. apart vertically and 16 ft. horizontally on four-legged double-circuit steel towers. The standard towers are spaced 650 ft. to 750 ft. apart. They are 66 ft. high, weigh 5544 lb., and are provided with cross-angle anchors buried 7 ft. in the ground. The strain towers, which are placed about one mile apart and on each side of important crossings, weigh 6880 lb. and are equipped with concrete footings. A 7/16-in. steel-strand ground wire is supported 3½ ft. above each circuit.

This diagram is based on the cost of constructing two reinforced-concrete gravity-type dams, containing 38,000 cu. yd. of concrete, one 660 ft. long and 93 ft. high (to the crest) and the other a smaller one but provided with an underlying reinforced-concrete mattress to carry the stresses imposed on the foundations. The large expense for freightage is due chiefly to rock having to be conveyed about seven miles by rail. About 58 lb. of corrugated-bar reinforcement was used per cubic yard of concrete. The work was first undertaken under contract, but given up by contractors with considerable loss, which is included in the costs.



FIGS. 6 AND 7—ANALYSIS OF UNIT COSTS OF EXCAVATING AND LINING THE TUNNEL

An arch-shaped, concrete-lined tunnel 6666 ft. long, having a net cross-sectional area of 151 sq. ft. and requiring an excavation of 56,000 cu. yd., extends from the intake to a surge tank above the penstocks. Throughout the entire length hard abrasive micaceous quartzite was encountered, which caused the loss of approximately 15 lb. of drill steel per linear foot of tunnel. Water-core hammer drills were used almost exclusively. In driving the tunnel the upper-heading or bench method was abandoned in favor of the lower-heading or stopping method, the latter costing $3.779 per cubic yard in comparison with $4.315 per cubic yard by the first method. The concrete lining of the tunnel (amounting to 18,966 cu. yd.) was placed by using steel forms and injecting the mixture through 8-in. spiral pipe by compressed air. About 80 per cent of the aggregate material used in the tunnel lining was obtained near one of the three adits to the tunnel. All sand was rolled from the rock so that only cement and supplies were transported. Grouting cost $0.0908 per square foot of lining.

and similar to the substation in Atlanta. There are five of these substations in operation, with a present rating of 16,500 kw. and an ultimate rating of 30,000 kw. One substation has a present rating of 1500 kw., three a rating of 3000 kw., and one a rating of 6000 kw. The ultimate rating of each of the first four is double that at present, with the 6000-kw. station arranged for a 9000-kw. ultimate load.

Considerable experimenting was necessary before a satisfactory telephone-line construction was secured. The telephone line from Tallulah Falls to Atlanta was completely reinsulated, using 40,000-volt suspension-type insulators instead of the usual pin type. This work has made the unit cost appear high. The costs for about 200 miles of circuits are shown in Table II.

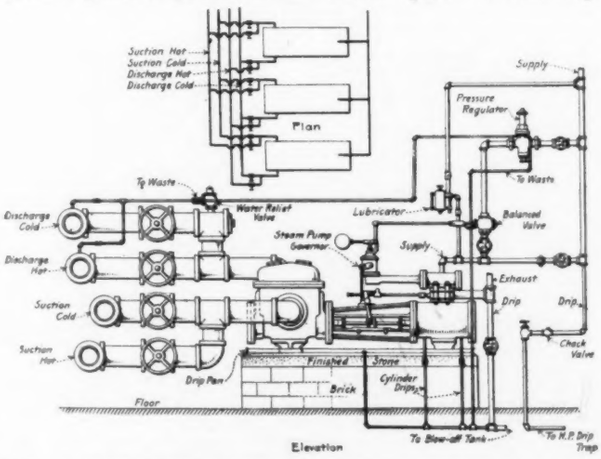
Effect of Stray Fields on Direct-Current Meters

While it is generally known that the registration of meters is influenced by surrounding magnetic fields, the extent to which accuracy is affected is a matter often questioned. From tests made with one type of direct-current meter the Metropolitan Electric Company, Reading, Pa., has found that a cable carrying 600 amp. at a distance of 12 in. from the meter affected its accuracy 50 per cent on light, or one-tenth, load. The direction of the current determined whether the meter ran fast or slow. The same current with the same cable only 2 in. away but in a different direction had no appreciable effect on the accuracy, showing that the relative positions of the meter and cable are the governing factors.

In another case a 300-amp. direct-current meter would not register on less than 50 amp., owing to the interfering magnetic field from an adjacent conductor. Meters may also be influenced by their own leads if brought around the instrument, or by the proximity of other meters. When three direct-current meters were placed side by side, 12 in. center to center, the accuracy of the middle meter was affected by 5 to 10 per cent on one-tenth load when either of the other meters was carrying full load. To prevent this effect the meters should be placed at least 15 in. apart, the wiring arranged so that it does not encircle the instruments, and the leads run into the meter board in a horizontal manner from the left-hand side. Placing instruments near iron risers may also cause serious errors that might be avoided by carefully selecting a location. Four-pole direct-current meters were found to be less affected by stray fields than the two-pole types.

Control for Boiler-Feed Pumps and Piping Connections

The piping and connections for a method of controlling the operation of boiler-feed and other pumps are shown in the accompanying illustration. A pressure regulator automatically starts the pump when the line pressure drops below the desired point and stops the pump when the pressure becomes excessive. A speed regulator prohibits an excess speed or tendency



PIPING CONNECTIONS FOR STARTING, STOPPING AND CONTROLLING SPEED OF PUMPS

of the pump to race when a sudden demand is placed thereon. In this way an injury to the pumps or piping system is prevented. A water-relief valve, a lubricator and a complete system of drips are also shown.

The connections for the main water pipes to house or service pumps are shown schematically at the top of the diagram. This arrangement allows use of the same pumps for either hot-water or cold-water service as required. It is advisable to use three pumps, one for hot-water service, one for cold, with the third pump held in reserve for either service.

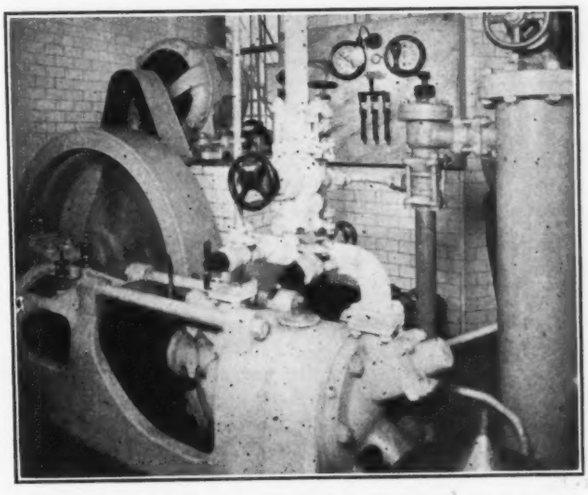
Utilizing Equipment in a Standby Station to Correct Line Voltage

To improve the voltage regulation on the southern end of its system when the Bakersfield steam reserve plant is not operating, the San Joaquin (Cal.) Light & Power Corporation drives one of the 2500-kva. turbo-generators in that station with an overexcited synchronous motor. In this way a much larger correcting current can be circulated throughout the line than with the motor operating unloaded.

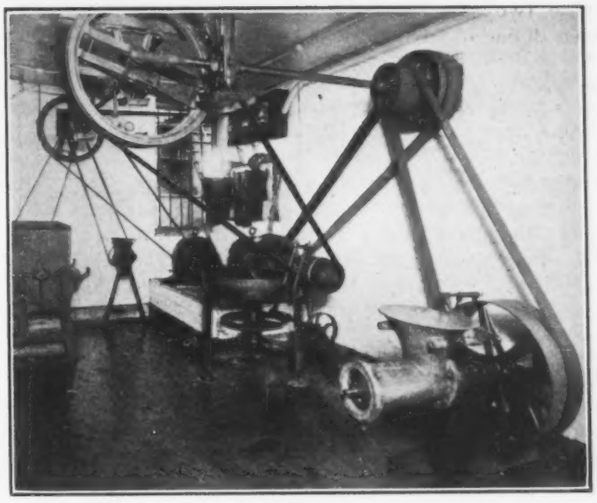
Two problems were involved in providing for this operation: One was to start the unit again in case it should drop out of synchronism during line trouble. The other was to ventilate the turbine blades, which were heated by churning the air in their cases. The first problem was solved by starting the unit up from its steam end when synchronizing is necessary. This does not entail operating more than the usual equipment, as one boiler must always be kept under pressure for operating fuel-oil pumps when the reserve equipment is called into service. Cooling of the turbine blades is accomplished by diverting air from the ventilating fan on the generator rotor through the turbine case, the ports on which are kept open. In case it is necessary to synchronize, the turbine ports are closed and the set is operated in the normal manner.

Motor Equipment and Energy Consumption in a Small Butcher Shop

Six alternating-current motors with a total rating of 49 hp. are used in a sausage factory at 62 East 110th Street, New York City. Two 10-hp. motors drive the sausage-making apparatus, one being connected to a meat chopper through a double-speed reduction of belting and pulleys. The other motor drives a line shaft to which are connected a mixer, a meat cutter and mixer, and the small machine shown against the rear wall. A 20-hp. motor operates an ammonia compressor that furnishes refrigeration for the meat-storage cases. In addition to this equipment, a 5-hp. motor is used to operate a freight elevator, a 2-hp. motor is connected to an air compressor, and one of the same rating is connected to an exhaust fan.



AMMONIA COMPRESSOR CONNECTED WITH MOTOR BY SILENT-CHAIN DRIVE



MEAT GRINDING AND MIXING MACHINES DRIVEN BY TWO 10-HP. MOTORS

These drives are in operation about fifty hours per week, and records for several months show an average monthly energy consumption of 2068 kw.-hr. or 42.2 kw.-hr. per connected horsepower. Electric service is furnished by the United Electric Light & Power Company, New York City.

High Steam Economy Shown by Swedish Steam Turbine

Some interesting steam consumption figures for steam-turbine operation in Sweden were given in a paper presented by E. A. Forsberg, Stockholm, Sweden, at the recent San Francisco meeting of the International Engineering Congress. The data of the accompanying table, taken from this paper, cover the performance of recent designs of the Ljungström turbine, for which a world record in steam economy is claimed.

This turbine consists of two reversely rotating disk wheels, each provided with a bucket system, consisting of buckets of small radial dimensions in which the steam expands according to the reaction principle. Usually

OPERATING DATA FROM TESTS OF LJUNGSTROM STEAM TURBINES

Turbine Rating, Kw.	Load, Kw.	Steam Pressure, Lb. per Sq. In. Abs.	Steam Temperature, Deg. Fahr.	Vacuum, Lb. per Sq. In. Abs.	Efficiency Turbo. Generator, Per Cent	Steam Consumption, Lb. Per Kw.-hr.
1000	1000.5	153.0	596.0	0.462	70.7	11.75
	756.4	120.0	588.0	0.400	69.4	12.20
	504.7	82.7	580.0	0.290	68.2	12.60
	1000.4	148.5	669.5	0.464	70.8	11.26
	995.5	148.3	652.0	0.464	71.0	11.35
	1384.3	157.0	612.0	1.000	72.0	12.35
1000*	1013.0	179.0	410.0	1.020	69.6	14.43
	739.0	135.0	379.0	0.803	68.7	15.30
	487.0	100.0	363.0	0.685	65.6	16.25
	250.0	59.8	327.0	0.614	58.6	20.00
2000	2000.0	213.0	662.0	0.70	75.9	10.65
5000	2000.0	213.0	662.0	0.70	79.7	10.10

*Turbine built by English licensees.

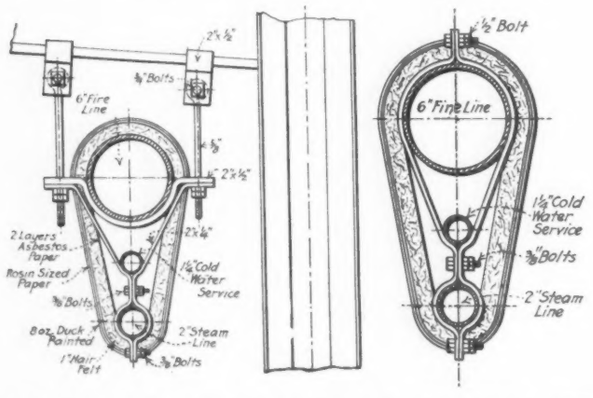
each disk wheel drives a separate electric generator, and these two are connected in parallel, thereby insuring even division of load. The use of the reaction principle of operation, the absence of the immovable bucket system, and small dimensions, it is claimed, make it possible for this turbine to show high steam economy.

The author points out that on account of the successful equalization of temperature strains throughout the turbine it can work at high degrees of superheat. Also, there seem to be no operating difficulties in the use of very high steam pressures with further improvements in steam economy over that shown in the accompanying table. This type of turbine is being tried out for vessel propulsion.

A Method of Protecting Water Lines from Freezing

An insulating scheme to protect fire or water service lines from freezing is shown in Figs. 1 and 2. A high-pressure or low-pressure steam line is run parallel with the water lines and inclosed by a suitable insulating covering. The resulting condensate in the steam pipe may be drained at the end of its run or at other points, as required, through steam traps and discharged to some point convenient to save the heat it contains. The steam main may be one which supplies some outlying structure if it has a capacity somewhat greater than necessary for its primary service. If the supply is used for heating, the condensate may be discharged through the radiators by means of connections taken from the bottom of the steam main.

The steam line will give up a portion of the heat units contained therein by radiation and convection to the water in the fire or other water lines which are installed just above, thereby maintaining these lines at a temperature above freezing while cold outside temperatures prevail. The steam main should be installed far enough below the water main to insure the best heating effect by convection; that is, in order that the air may be heated from contact with the hot surfaces of the steam pipe, rise because of its relatively lighter weight per equal volume, be cooled from contact with the cold surfaces of the water pipes, and then descend owing to its greater weight to repeat the cycle. However, the distance between the cooling surface and the source of heat must be kept consistent with economy, as any increase in this distance requires more covering, together with a further loss of heat from exposure of the additional covering to the atmosphere. It is generally advisable to use three layers of hair felt to protect exposed water lines from freezing, whereas with the method shown one layer is all that is necessary. An additional advantage may be obtained by the slight increase in temperature of the water in the service line when intended for use at lavatories or whenever it is desired to heat the water for various purposes.



FIGS. 1 AND 2—ARRANGEMENTS FOR SUPPORTING PIPES PROTECTED FROM FREEZING

An arrangement for supporting all three pipes directly from girders opposite columns is shown in Fig. 1. Fig. 2 shows a method of supporting smaller pipes midway between the main supports by hangers from a large fire line which is in turn supported as shown in Fig. 1. Lock-nuts are used on all bolts forming a part of these pipe supports to prevent loosening due to vibration.

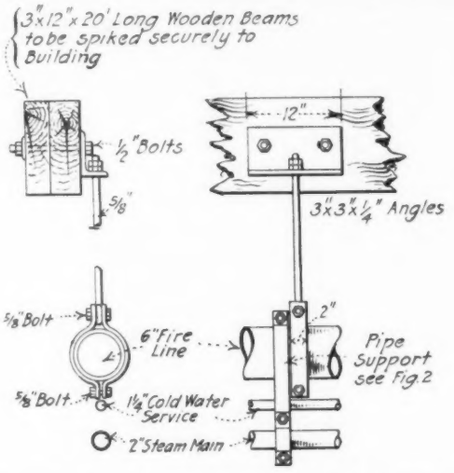


FIG. 3—DETAILS OF THE SUPPORTING ARRANGEMENT SHOWN IN FIG. 2

The pipe covering consists of an inner layer of two thicknesses of asbestos paper covered by one layer of 1-in. hair felt. This is wrapped with rosin-sized sheathing weighing not less than 8 lb. per 100 sq. ft. and lapped at least 90 deg. until a smooth hard surface is obtained. The whole covering is then inclosed with a jacket of 8-oz. duck securely held in place by one longitudinal smoothly sewed seam on a side not exposed to view. Where the covering is exposed to the weather an additional protective covering of Ajax No. 26 (U. S. G.) lead-coated sheet metal should be applied.

Expansion loops for all three pipes are advisable at various points. These may be of the design shown in Fig. 4, using a support for the offset of the loop at the point indicated.

The required size of steam pipe is obtained by equating the heat-unit losses per hour through the pipe covering and the amount of heat absorption per hour by the water in the fire and service lines against the heat supplied by that portion of the radiating surface of the steam pipe which is exposed to the inclosed air space. The losses per degree of temperature difference may be obtained from well-established tables of the manufacturers for the type of covering considered. Similarly, the factor of transmission from the steam pipe is that commonly used for bare pipe.

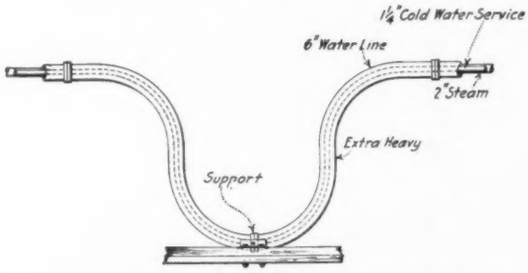


FIG. 4—AN EXPANSION LOOP FOR THREE-PIPE LINES

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

Should the Salesman Collect Money?

The Experience of Many Central Stations, and What Central-Station Managers and Commercial Agents Say About It

BY EARL E. WHITEHORNE

IT is certainly surprising how much difference of opinion can exist among a group of men of wide experience in the selfsame work. But it is always interesting to gather such conflicting testimony together and to find out what is really the consensus of opinion and what weight of common experience has induced the majority to look upon it that way. The question of whether or not the central-station salesman should be utilized for making difficult collections is an abstract matter of administration, yet it is a most delicate point of contact between the company and the public and a most important question, worth the careful thought of every manager. This article has been written to spread the evidence and throw more light upon the subject, in the belief that it will carry valuable suggestions to many managers.

One poor collector in a busy morning can make more trouble than six salesmen can undo in three days' work. Perhaps the foregoing statement exaggerates the proportion just a trifle, but I doubt it—for to throw a handful of machine bolts into the vitals of a whirling generator is a mild and pleasant pastime in comparison. Generators cost about so much, but enemies work expense beyond all calculation, and, as every manager knows, there is no easier way to lose a friend than by a lack of tact in handling the collection of a disputed bill. The question arises, therefore, how such a bill *should* be collected, and if, after all, it isn't better for the sales department of a central station to have charge of the collecting of such difficult accounts. Opinion differs so widely that I have been corresponding with some fifty companies about it to find out just what their own experience has been. The evidence is extremely interesting.

Naturally, the point at issue simmers right down to the question of who is the best man in a pinch—the salesman or the collector—and whether the collector should handle the case right to the bitter end of cutting off, instead of letting the salesman intercede and try to save the business. Some say he should follow the latter course, because it is better to save a dollar that you have than to work and win another. Some say the collector himself should be good enough to turn the trick and that the sales department never should be tangled up in such collection troubles. The men on both sides talk from practical experience and agree that the issue is one of the most vital in the business.

Puts Salesman at Disadvantage

William Rawson Collier, sales manager of the Georgia Railway & Power Company of Atlanta, Ga., expresses himself as decided in opposition. He says:

"My answer is no. Personally I do not believe that very many salesmen are good collectors. I am afraid that the tendency nowadays is to make the sales department the 'goat' if possible, the idea being that as the sales department is so anxious to get a customer and keep him, and as it is generally in such close touch with the customer, the easiest way to explain poor operation or collect a bill is simply to put it up to the salesman and let him straighten the matter out. Psychologically this is wrong, because a man is always at a disadvantage if he is trying to collect a bill, and I believe one of the best and most necessary requisites of a successful salesman is confidence and a feeling that he is meeting his prospective customer on an equal footing. Generally a bill collector does not feel this way.

"We find it better to have a regular corps of collectors trained thoroughly in the general policies of the company, and in almost every case they can handle the accounts. There are cases, however, especially with large accounts and important customers, where the case is referred to me by the treasurer, and either I or my assistant handles the matter personally. I find that this is really the best plan."

Collecting Requires Good Salesmanship

It comes right down to a matter of opinion and experience as to whether the salesman is personally compromised by dabbling in collections. A. E. Oltz, industrial engineer for the Northern Indiana Gas & Electric Company in Hammond, Ind., sees no danger of it because he feels that when relations with a customer become involved no man is so well qualified by training and by reputation to investigate and smooth away the wrinkles.

"My personal experience has convinced me that all difficult accounts should be collected by the new-business department," he says. "The regular collectors should actually be competent, experienced salesmen, for collecting accounts requires more tact and diplomacy than ordinary selling, and, after all, the proper sort of collecting comes pretty close to being high-grade salesmanship, and the work of the new-business department in building up the good will of the company should not be destroyed by the tactless handling of accounts by a collector. Where the account is large the best sales ability the company has in its employ should be used, for the

salesman, with his knowledge both of the customer and the details of the controversy, can properly explain away any misunderstanding that may exist.

The Salesman as the Customer's Champion

"My experience in collecting difficult accounts is that nine out of ten customers are honest and will pay their accounts if fully satisfied that the charge is just and that they have really received the value of what they are expected to pay. I have found, when called upon to press a collection, that, instead of injuring my standing with the customer, it has done the reverse. My relations afterward were, if possible, closer than before taking up the task of the collection.

"The salesman should be his customer's champion and should supervise all relations between the customer and his company. He should take a firm, diplomatic, dignified stand in favor of his company and should represent both the consumer and the company impartially. If his company is in the right, he should get the money. If his company is in the wrong, he should defend the customer and should insist upon just treatment being accorded to him.

"I will confess that before carefully analyzing the matter of collections I had the usual opinion that collecting of difficult accounts would injure my standing with the customer and prevent my approaching him on further deals. I have since found just the opposite to be the case, and now insist that the handling of my customers be left to me, no matter what the conditions—whether pleasant or unpleasant. I appreciate that it adds considerably to the salesman's work to do this when he might be following new business, but I am strong in the belief that it is fully as important that an existing customer should be kept a satisfied consumer as it is to obtain new business. However, I have not found it necessary to lose any new business while taking care of that already existing, and the proper handling of old consumers has resulted in growth of their business with us."

Salesman Should Be Utilized

Carrying the thought a little further, T. I. Jones, general sales agent of the Edison Electric Illuminating Company of Brooklyn, says:

"The salesman should be utilized in emergencies to collect difficult accounts by all means. My own position has been always that the salesman is really a little more than a dispenser of the commodity which the company has to sell. It should be his duty not only to interest the prospective customer in the company's goods and to sign his contract, but also to follow up the handling of the contract once it is signed, so that connection may be made promptly; and, further, to call upon the customer from time to time after he is connected, with a view to seeing if he is satisfied in every way with the service. This can only be done by having the salesman continually calling on existing customers with a view to increasing their use of energy, and if at any time they are dissatisfied in any way with the service it is his duty to see that all complaints or troubles are remedied in the easiest possible way. In short, the salesman should be used as the intermediary between the customer and the company."

T. I. JONES

Experience in Little Rock

This matter of the extra work imposed on the salesmen led to the abandonment of the practice in Little Rock, Ark. A. E. Smith, commercial manager of the Little Rock Railway & Electric Company, says:

"Less than six months ago the question of collections was given serious consideration by the auditing department and commercial department of the Little Rock company, with the result that the commercial department took over the entire collections for several months. This resulted in more collections being made, with customers better satisfied, fewer complaints and more prompt adjustment of bills on the one hand, but a great decrease of new business on the other hand. The one trouble which we have found is that the salesman cannot devote the proper amount of time to the securing of new business and that the new business begins to slump as soon as collections are turned over to the salesmen. I firmly believe that the commercial department should handle the collections of a company and that the collector should be known as a special representative who reports directly to the commercial manager.

"The matter of collections does not necessarily involve the salesman in any dispute with the customer, as, if properly handled, the salesman can state that he is not a collector but is acting merely as a friend of the customer to save the latter any annoyance due to disconnection of service and trouble with the credit department."

Salesman Really Responsible

But, as F. H. Golding, general manager of the Atlantic City (N. J.) Electric Company, points out: "The salesman is entitled to an opportunity to hold his business, for the loss of a consumer through disconnection for non-payment counts against his record. When he succeeds in doing so he is of more value to his company than if he devoted the same amount of time to securing, and secured, new consumers, because he is holding revenue which entails no investment expense, while, on the other hand, the new consumer he would obtain in the same space of time would entail a certain investment on the part of the company.

F. H. GOLDING

"The commercial manager is always prone to feel that the time his salesmen devote to collecting could be employed with more direct profit to his department in soliciting further business. However, the salesman is responsible for the presence of the particular consumer, and as most of the arguments relative to disputed bills are based on statements purporting to have been made by the salesman, it would seem to me that he is the logical man to straighten out such disputes."

Called In as Arbitrator

That seems to be the general preference, and the majority of companies have apparently made it standard practice for the salesman to make a final endeavor to arbitrate before the disconnection of a customer is ordered. In Allentown, Pa., A. H. S. Cantlin, general manager of the Lehigh Valley Light & Power Company, has his salesmen accompany the collector in cases of dispute to act as the friend of the consumer and endeavor to demonstrate the fair-mindedness of the company.

"By thus working together," he says, "our entire organization is fully conversant with any difficult case and is a unit as to the correctness of the matter, and we can usually make a customer see the matter in our light. If not, we get the customer in a position where he must himself feel that he is taking an arbitrary and unreasonable stand, under which conditions we, of course, have to use our judgment in proceeding to more drastic measures. This brings in the sales department, but only in the position of arbitrator between the collector and the customer, which is a help rather than a detriment to selling effort for the future."

The Influence a Good Thing

The influence of a little collection work is a good thing for the selling man. John G. Larned, assistant to the vice-president of the Public Service Company of Northern Illinois, says:

"The salesman should be thoroughly impressed with the fact that it is more important to hold existing business than to secure new business."

Robert Montgomery, commercial manager of the Louisville (Ky.) Gas & Electric Company, says:

"I have also found that the experience of collecting a few bad accounts which he has incurred has a tendency to make a salesman more conservative and careful in his work. When a salesman is relieved from all responsibility as to the collections, it encourages him to make contracts without any thought as to the credit rating of the customer."

R. MONTGOMERY

A. A. Brown, sales manager for the Consumers' Power Company of St. Paul, Minn., says:

"A good feature of the plan is that it will make every salesman more careful about signing contracts with customers who are not 'good pay,' and he will be more likely to obtain deposits in signing contracts, as he will learn by experience that it is easier to obtain a deposit on signing a contract than it is to collect a bad debt afterward."

Van Dusen Rickert, assistant manager of the Eastern Pennsylvania Railways Company in Pottsville, Pa., remarks:

"We find that our salesmen, from their habit of meeting people, are good collectors. Furthermore, they learn to value good accounts and they get a better perspective of their prospects for new business. We do not know of any cases where they have weakened themselves materially with the public."

V. D. RICKERT

In short, the weight of evidence seems to indorse the use of the salesman, for, after all, as W. F. Chestnut, commercial manager for the Union Light, Heat & Power Company of Fargo, N. D., puts it:

"Nothing is thoroughly sold until it is paid for, and in collecting the account the salesman is only completing the sale."

It is extremely easy for the sales department and the credit department to forget that they are working for a common purpose.

"Experience has taught us," says an Indiana manager, "that the credit department in an effort to collect an account will often lose sight of the interest the new-business department has in the consumer in the way of increasing the use of electricity or in keeping the consumer on the lines of the company. Likewise the new-business department, in an effort to close a deal, may in some cases be too liberal or not exacting enough in securing a deposit or guarantee on an application for service or appliances."

This manager therefore counsels that each salesman keep in close touch with the credit situation in his territory and co-operate in every way he can to avoid the loss of business.

The Credit Man's Attitude

And how does the credit man feel about it all? The following from a letter signed by F. W. Johnson, district credit manager for the Northern Electric Company of Toronto, Ont., gives the answer:

"In stating that I am in favor of salesmen assisting the credit manager in emergencies, I should like to point out that a credit man cannot be successful in his work unless he works very harmoniously with the sales manager, and by working closely at all times and taking the sales manager into his confidence he will obtain co-operation that is invaluable. Every credit man has found, and will continue to find, the salesman who is always considering just the bulk sales. Until that salesman is made to know that bad accounts destroy profits that salesman will argue that he will be harassed in his work by being requested by the credit man to inquire of one of his customers why that customer ignores the letters from the credit manager.

"We in our line of work rely upon the salesman for information regarding a new customer to a large extent, and if, after any customer has received a line of credit based upon the good report which accompanied the initial order from the salesman, that customer 'falls down' in his payments and absolutely refuses to reply to correspondence regarding his account, surely the credit man is perfectly justified in going to the sales manager and asking him to have that particular salesman find out the reason.

"If the good understanding between the sales manager and the credit manager will lead to this, why should the salesman not collect? It would not accomplish anything at all if the salesman just asked the customer to reply to the letters from the credit man, expressing the hope that the customer would send along a check. The salesman should certainly ask to be allowed to send it in himself, for if the debtor is negligent in one instance he will be so in another, and the salesman's reasoning would be wasted. The cases, however, are so exceptional that I cannot see the reason for condemnation of the utilizing of the salesman; but if the practice were to become a prevalent one I should certainly be against it, because undoubtedly the salesman would be harassed in his salesmanship and a majority of his customers would resent his visits rather than welcome him. It is the duty of all of us to keep away from bad accounts, and no one suffers more than the sales manager."

In short, the answer is to take the steps that promise both to get the money and to hold the friend, which means in case of trouble to send the man who knows the customer best—the salesman. For the basic purpose of the enterprise is to make a profit for the stockholders, and the collection of the bills is quite as important as the operation of the plant. Let the salesman lend a hand.

Labor Costs in Interior Construction

Second Article in a Series on Business Methods in Electrical Contracting Work, Begun on Page 870 of Last Week's Issue

BY LOUIS W. MOXEY, JR., VICE-PRESIDENT KELLER-PIKE COMPANY, PHILADELPHIA

THE labor item in the electrical contracting business is subject to changes due to variations in the price of labor resulting from increases or decreases of rates and to variations in the unit costs with the nature of the building construction. The latter variations may amount to 100 per cent or more.

The cost of labor can be determined with a fair degree of accuracy for buildings of various types, such as those of brick-and-joist construction, structural-steel construction with terra-cotta or concrete floors, and reinforced-concrete construction, by the following method, which may be worked out as elaborately as necessary and made to cover not only the labor required for installing different sizes of conduit, wires, etc., but also the labor required for connecting various sizes of wires to switchboards, dynamos, lugs, etc.

When a contract is secured in which the unit price of labor is not accurately known to the contractor, and where this information is desirable for future estimating, he should endeavor to obtain these data on the new contract. This can easily be done by the method that will be outlined in a future article.

Tables of Labor Cost for Interior Construction

In Tables XII to XXVI labor costs for installing various kinds of apparatus and materials are given. These data can also be kept in curve form as previously explained. The data given, however, cannot be considered general in their applications, for conditions vary widely in the electrical contracting field. Every contractor should make his own tables and curves, utilizing his records for the purpose. In all the following tables it is assumed that the rates for labor are 55 cents per hour for foremen, 45 cents per hour for wiremen, and 25 cents per hour for helpers. All figures given include an allowance for what has been found to be necessary supervision by the foreman in the class of work under consideration.

If the items entering into architects' and engineers' specifications were always given in succession from point of supply to the outlets, the chances of the electrical contractor omitting items in his estimate would be considerably reduced. Whether or not the architects or engineers write their specification in that form, the contractor should prepare his estimate so.

If an engine is to be installed in the plant, the contractor's first items should be for engines, foundations, painting, etc. Next should come the item for generators. If these be belted machines, the belts could be included under this item. Then should come the dynamo cables installed and connected to the lugs of the dynamos and switchboard. This should be followed by the item

Page 2 Estimate No. 10,176

Item	Labor and Materials	Unit Price		
Light mains, three-wire.	200 ft. 2-in. conduit, loricated	$0.20	$40.00	
	3 2-in. L's, loricated	0.30	0.90	
	3 2-in. couplings, loricated	0.10	0.30	
	1 2-in. condulet (three-wire)	....	2.00	
	600 ft. No. 0 D. B., N. E. C. S.	0.15	91.50	
	Labor, conduit	0.25	50.00	
	Labor, wire	0.05	30.50	
	Supports, junction box, etc	....	7.00	$222.20

FIG. 2—APPLYING THE DETAIL METHOD TO MAINS

Page 3 Estimate No. 10,576

Item	Labor and Materials	Unit Price		
Light branches.	400 ft. ½-in. conduit, loricated	$0.06	$24.00	
	200 ft. ¾-in. conduit, loricated	0.07	14.00	
	600 ft. No. 12 duplex, N. E. C. S.	0.03	18.00	
	200 ft. No. 12 single, N. E. C. S.	0.15	3.00	
	Labor, ½-in. conduit	0.08	32.00	
	Labor, ¾-in. conduit	0.09	18.00	
	Labor, No. 12 duplex	0.01	6.00	
	Labor, No. 12 single	0.08	1.60	
	Supports, etc	....	3.40	$120.00
Outlets	20 light outlet boxes, T. & B.	0.20	4.00	
	Labor	0.30	6.00	
	20 studs on supports, T. & B.	0.15	3.00	
	Labor	0.20	4.00	
	5 switch boxes	0.25	1.25	
	Labor	0.30	1.50	
	5 switches, D. P., Cutter	0.80	4.00	
	Labor	0.20	1.50	
	Bushings, etc	....	5.00	30.25

FIG. 3—APPLYING THE DETAIL METHOD TO BRANCH CIRCUITS

of switchboards installed complete with instruments, circuit-breakers, etc. This would practically complete the plant unless a storage battery was to be installed. A miscellaneous item could be inserted either at this point or under the general expense item at the end of the estimate covering the tests and if necessary the water rheostat.

The estimate should then include the following items in the succession here given, the costs of both material and labor being entered:

Connection of power and light feeders to switchboard.
Flexible tubing, junction boxes, conduits, etc.
Power feeders, mains and sub-mains.
Power panels, boxes, doors, trim and fuses.
Power branches.
Power outlets, such as switches, starters and the like, erected and connected, wiring between switches, starters, etc., and motors.
Motors and foundations, delivered, erected and connected.

This would complete the power portion of the estimate, and the lighting portion should follow, the items being taken in the order given below:

Light feeders, mains and sub-mains.
Panelboards, panel boxes, doors, trim and fuses.
Branches.
Outlets.
Expenses, cartage, freight, car fare, railroad fare, loss of time, inspection fees, shanty, telephone, bond, insurance and miscellaneous.

The same method should be followed in making an estimate for telephone, telegraph, fire-alarm, watchman's-clock, time-clock, annunciation and similar systems.

An estimate for light branches according to this detail method would appear as shown in Fig. 3.

What might be called the semi-detail method can generally be used for quick estimating with fairly accurate results. It consists of a combination of the labor and material costs. Take, for example, the item of mains in an estimate. If made in detail, it would be as shown in Fig. 2.

It will be noted that the total cost for running 200 ft. of main consisting of three No. 0 wires is $222.20,

TABLE XII—COST PER KILOWATT FOR ERECTING BELTED GENERATORS

Size in Kw.	Normal Condition	Easy	Difficult	Cost of Painting
1 – 5	$1.00	$0.75	$1.50	$0.60
5 –12½	1.00	0.75	1.50	0.60
12½–25	1.00	0.75	1.50	0.50
25 –50	1.00	0.75	1.50	0.40
75	0.80	0.60	1.25	0.30
100	0.75	0.60	1.20	0.25
150	0.60	0.50	0.90	0.20
200	0.50	0.40	0.80	0.18
300	0.40	0.30	0.60	0.15
500	0.30	0.20	0.50	0.12

TABLE XIII—COST PER KILOWATT OF FOUNDATIONS FOR BELTED GENERATORS*

Size in Kw.	Normal Condition	Easy	Difficult
1 – 5	$2.00	$1.50	$3.00 to $4.00
5 –12½	2.50	2.00	3.75 to 5.00
12½–25	2.00	1.50	3.00 to 4.00
25 –50	1.50	1.00	2.25 to 3.25
75	1.20	0.85	1.80 to 2.80
100	1.00	0.75	1.50 to 2.50
150	0.85	0.60	1.25 to 2.25
200	0.75	0.60	1.00 to 2.00
300	0.60	0.50	0.90 to 1.80
500	0.50	0.40	0.75 to 1.50

*The items under this heading include the cost of labor and materials, which is the usual method of estimating this class of work. The figures are based on the average cubical contents of foundations specified by generator makers. If the electrical contractor is to furnish the belt or belts, the labor for putting them n place should be included.

TABLE XIV—LABOR FOR ERECTING SWITCHBOARD PANELS

	Dynamo Panel without Sub-Base	Dynamo Panel with Sub-Base	Feeder Panel without Sub-Base	Feeder Panel with Sub-Base
Cost per panel...	$10.00	$12.00	$12.00	$15.00

TABLE XV—LABOR PER LEAD FOR CONNECTING SWITCHBOARD AND DYNAMO LEADS*

Size, B. & S.	Paper and Lead	Rubber and Lead	Rubber or Slow-Burning Insulation
14–8	$0.33	$0.30	$0.21
6	0.45	0.41	0.28
5	0.55	0.50	0.33
4	0.66	0.60	0.40
3	0.80	0.72	0.49
2	0.87	0.79	0.53
1	0.92	0.84	0.56
0	1.00	0.90	0.60
00	1.04	0.94	0.63
000	1.08	0.98	0.65
0000	1.14	1.03	0.69
Circ. mils			
250,000	1.18	1.08	0.72
300,000–350,000	1.34	1.22	0.78
400,000–450,000	1.43	1.30	0.84
500,000–550,000	1.60	1.44	0.90
600,000–650,000	2.10	1.90	1.00
700,000–750,000	2.50	2.25	1.25
800,000–850,000	2.95	2.65	1.50
900,000–950,000	3.30	3.00	1.75
1,000,000	3.75	3.40	2.00

*These figures are the labor costs for soldering cables into lugs at the switchboard and generators, also for soldering light and power cables into lugs of switches on the switchboard. They include the cost of arranging the cables in a neat and workmanlike manner at these locations.

TABLE XVI—LABOR COSTS (IN CENTS) PER FOOT OF CONDUIT WORK*

Size of Conduit	Steel-Terra-Cotta Construction				Concrete Construction				Slow-Burning Construction			
	Exposed		Concealed		Exposed		Concealed		Exposed		Concealed	
	Small Am't	Large Am't	Small Am't	Large Am't	Small Am't	Large Am't	Small Am't	Large Am't	Small Am't	Large Am't	Small Am't	Large Am't
½	7	6	6	4	8	7	7	5	6	5	6	4
¾	8	7	7	5	9	8	8	6	7	6	7	5
1	9	8	8	6	10	9	9	7	8	7	8	6
1¼	10	9	9	7	11	10	10	8	9	8	9	7
1½	11	10	10	8	12	11	11	9	10	9	10	8
2	12	11	11	9	15	12	12	10	12	10	11	9
2½	15	12	12	10	20	15	15	12	15	12	12	10
3	20	15	15	12	25	20	20	15	20	15	15	12
3½	25	20	20	15	30	25	25	20	25	20	20	15
4	30	25	30	20	40	30	30	25	30	25	30	20

*The figures given in the table of costs for conduit work are for work in new buildings and include the labor cost of preparing for and running rigid conduit per foot, as well as the labor on junction boxes. If conduits are to be installed in old buildings, the cost figures would be considerably greater than those given in the table, the percentage of increase depending on the conditions. However, for concealed work in existing buildings flexible conduit (see Table XVII) is generally used in order to do as little tearing out as possible.

TABLE XVII—FLEXIBLE-CONDUIT LABOR COSTS PER FOOT FOR CONCEALED WORK IN EXISTING BUILDINGS*

Size, Inches	Slow-Burning Construction	Fireproof Construction
½	$0.08	$0.10
¾	0.09	0.11
1	0.10	0.12
1¼	0.12	0.15
1½	0.15	0.20
2	0.20	0.30
2½	0.30	0.40
3	0.40	0.50

*The figures include cost of preparing for and running. There is little difference in cost whether the amount is large or small.

TABLE XVIII—COST PER FOOT OF FISHING CONDUITS AND PULLING WIRES*

Size	One Wire per Conduit	Two or More Wires per Conduit
B. & S.		
14	$0.005	$0.004
12	0.006	0.004
10	0.0065	0.005
8	0.0075	0.006
6	0.0085	0.0065
5	0.01	0.007
4	0.013	0.0075
3	0.016	0.008
2	0.023	0.013
1	0.025	0.016
0	0.03	0.02
00	0.04	0.023
000	0.045	0.025
0000	0.05	0.03
Circ. mil.		
250,000	0.055	0.04
300,000–350,000	0.065	0.045
400,000–450,000	0.075	0.055
500,000–550,000	0.08	0.065
600,000–650,000	0.09	0.075
700,000–750,000	0.09	0.085
800,000–850,000	0.10	0.09
900,000–950,000	0.11	0.09
1,000,000	0.12	0.10
1,250,000	0.12	0.10
1,500,000	0.12	0.10
1,750,000	0.12	0.10
2,000,000	0.12	0.10

*These figures are for large amounts of rigid or flexible conduit in either new or existing buildings. For small amounts the figures should be increased from 10 to 30 per cent.

TABLE XIX—LABOR COST OF INSTALLING PANELBOARDS AND BOXES

Number of Circuits	Boxes				Panels Installed and Connected	Doors and Trim
	New Buildings		Old Buildings			
	Exposed	Concealed	Exposed	Concealed		
1- 6	$1.00	$1.00	$1.00	$2.00	$1.00	$0.40
8-10	1.25	1.25	1.25	2.25	1.50	0.50
10-14	1.50	1.50	1.50	2.50	2.00	0.60
16-20	2.00	2.00	2.00	3.00	3.00	0.75
24-30	2.50	2.50	2.50	4.00	4.00	1.00

TABLE XX—LABOR COST OF INSTALLING AND CONNECTING MOTORS*

Hp. of Motor	Mounting		
	Floor	Ceiling	Wall
1 - 2	$1.00	$1.50	$1.50
3 - 5	3.00	4.50	3.50
7½–10	6.00	9.00	7.50
15	10.00	15.00	12.00
20	15.00	22.00	18.00
25	20.00	30.00	24.00
35	25.00	37.00	30.00
50	35.00	51.00	42.00
75	50.00	75.00	60.00
100	75.00	110.00	90.00
150	100.00	150.00	120.00
200	150.00	225.00	180.00

*Includes labor on supports.

TABLE XXI—COST OF LABOR FOR INSTALLING AND CONNECTING SWITCHES AND RECEPTACLES

Single-pole switches	$0.20	Door switches	$0.20
Double-pole switches	0.25	Wall receptacles	0.20
Three-way switches	0.30	Floor receptacles	0.30
Four-way switches	0.25		

or $1.10 per foot. The contractor could prepare tables of unit prices for all items in an estimate, such as for two-wire to nine-wire service connections, two-wire to five-wire mains, two-wire and three-wire branches, etc., showing their cost for buildings of various types of construction. The disadvantage of this method, however, is that a change in price of materials diminishes the accuracy of the tables.

Quick Estimating

It is impossible to give an accurate method for quick estimating, as the accuracy of the results obtained is entirely dependent upon the experience of the estimator and his knowledge of the building to be wired. Some contractors base quick estimates upon the cubical contents of buildings, while others estimate the material required and assume the labor item to be a certain percentage of this. The writer has found that the only quick method that is satisfactory is one basing the estimate on the number of outlets and utilizing data obtained from previous installations of a similar nature.

Take the following example, which is the cost for wiring a new residence of brick and joist construction by the concealed-conduit method. The service cables were run down the outside wall, the meter being installed in the basement. The system was three-wire,

TABLE XXII—LABOR COST OF INSTALLING OUTLET BOXES AND SUPPORTS

Type of Outlet	Old Buildings		New Buildings		
	Steel and Terra-Cotta	Slow-Burning	Concrete	Steel and Terra-Cotta	Slow-Burning
Light outlets	$0.35	$0.30	$0.30	$0.25 *	$0.20
Fixture supports	0.10	0.10	0.10	0.10	0.10
Switch boxes	0.35	0.30	0.30	0.25	0.20
Wall-receptacle boxes	0.35	0.30	0.30	0.25	0.20
Floor-receptacle boxes	0.50	0.45	0.60	0.40	0.30

TABLE XXIII—LABOR COSTS FOR INSTALLING MOTOR-CONTROL APPARATUS

Hp. of Motor	Switch and Rheostat	Controlling Panel Complete, Switch, Rheostat, Etc.
1 - 2	$0.75	$2.00
3 - 5	1.00	3.00
7½–10	2.00	4.00
15	2.50	5.00
20	3.00	6.00
25	3.50	7.00
35	4.50	9.00
50	6.00	11.00
75	8.00	13.00
100	10.00	15.00
150	12.00	17.00
200	15.00	20.00

TABLE XXIV—LABOR PER FOOT OF WIRE FOR INSTALLING CONCEALED KNOB-AND-TUBE WORK

Size of Wire, B. & S.	New Buildings	Old Buildings
14	$0.01	$0.03
12	0.01	0.03
10	0.01	0.03
8	0.012	0.035
6	0.015	0.045
5	0.018	0.055
4	0.02	0.06
3	0.023	0.07
2	0.025	0.075
1	0.03	0.09
0	0.03	0.09
00	0.035	0.11
000	0.035	0.11
0000	0.04	0.12

110-220-volt, single-phase. The panelboards were of slate with 30-amp. type B switches, mounted in iron boxes, with wooden doors and trim. The switches were of Cutter manufacture and the receptacle of the flush wall type and of Pringle manufacture. The wire was rubber-covered and of the National Electrical Code standard.

The shop cost as shown by the contract ledger was $400.75, the cost items being as follows:

Materials	$254.36
Labor	136.74
Car fare, etc.	9.65
Shop cost	$400.75

TABLE XXV—LABOR PER FOOT OF WIRE FOR INSTALLING EXPOSED KNOB-AND-TUBE WORK*

Size of Wires, B. & S.	Running Wire After Backboard or Buttons Are Erected	Erecting Backboard or Buttons
14	$0.015	$0.02
12	0.015	0.02
10	0.015	0.02
8	0.017	0.025
6	0.02	0.03
5	0.02	0.035
4	0.023	0.04
3	0.025	0.045
2	0.03	0.05
1	0.035	0.06
0	0.035	0.07
00	0.04	0.08
000	0.045	0.09
0000	0.045	0.10

*When good knob-and-tube work is installed in new and old buildings the labor at outlets will be practically the same as given in Table XXII under the several headings, and the labor for switches and receptacles should be exactly the same as in Table XXI.

The residence had thirty-two light outlets, twenty-eight switch outlets and twenty receptacle outlets. The cost of a switch plus the labor of installing it was $1 and the cost of a receptacle plus the labor of installing it was $1.10.

If all outlets were light outlets, the shop cost would have been approximately $400.75 — [(28 × $1) + (20 × $1.10)] or $350.75. Dividing $350.75 by the total number of outlets, which is 80, $4.38 is obtained. Hence $4.38 is the cost of wiring per light outlet. The cost of wiring a switch outlet is $4.38 + $1, or $5.38, and the cost of wiring a receptacle outlet is $4.38 + $1.10, or $5.48.

This method is fairly accurate for small-residence work, and any number of costs per outlet may be compiled to cover the various types of wiring construction, wiring systems, etc.

TABLE XXVI—LABOR COST PER FOOT FOR INSTALLING MOLDING

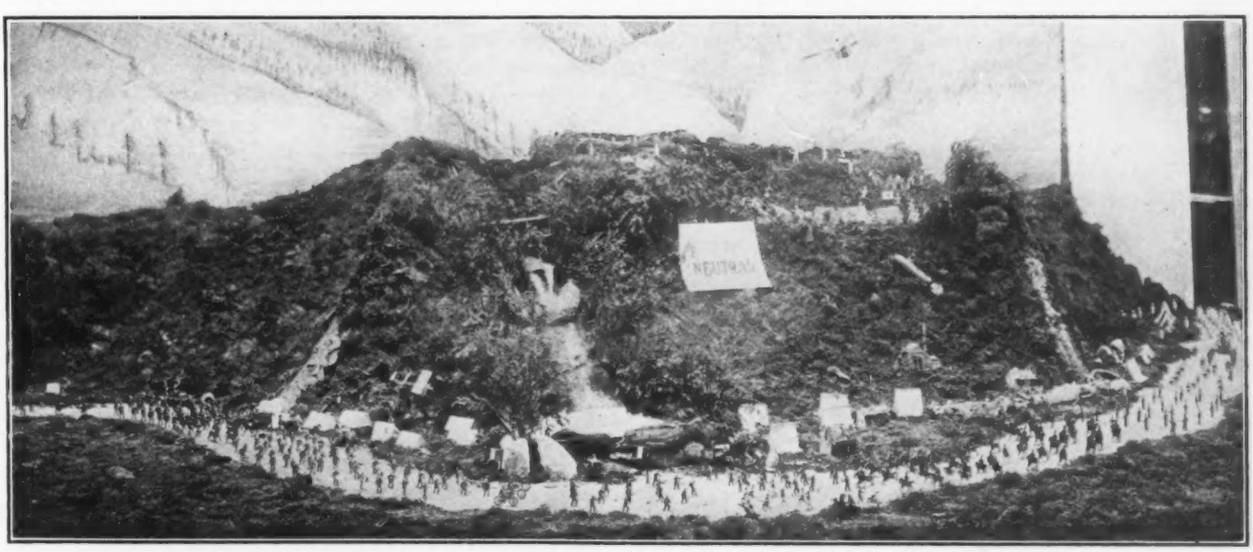
Wires		Wood Molding	Metal Molding
Number	Size, B. & S.		
2	14	$0.04	$0.08
2	12	0.05	0.08
2	10	0.06	0.08
2	8	0.07	....
2	6	0.08	....

*Metal molding is not made in sizes larger than for No. 10 wires, and wood molding is seldom used for wires larger than No. 6. The labor at outlets with molding is practically the same in the case of both wood and metal-molding construction. Tables similar to Tables XXI and XXII can hence be made.

Using the Show Window for Indirect Advertising

Although department stores and other merchandising establishments generally utilize their show windows for direct advertising through displays of goods on sale, not infrequently space is given to purely spectacular displays in which no goods are shown. When these displays are elaborate and possess some human-interest feature, the windows that they occupy are not wasted but are of considerable indirect advertising value.

This type of advertising was recently employed by the Springfield (Ill.) Gas & Electric Company, its show window being dressed with the war-time window display shown in the accompanying picture. The setting was composed of natural moss, ferns and mountain rock, and a stream of water was caused to flow down the artificial mountain, thus creating miniature falls, arranged to add to the beauty of the setting. The display purported to depict the warring of the nations in the foothills of the Vosges mountains. Soldiers were shown marching along the paths to the martial tone of a "Victrola," equipped with piping extending to the sidewalk in front of the window. By a mechanical device, suddenly from out of the trenches companies of the tiny lead soldiers were caused to rise, fire at the enemy, and disappear. Cannons were shown in action to the right and left, and an airship hovered over the scene of the conflict. The entire display was operated electrically, at a nominal cost, and fully 300 metal soldiers, cannons, automobiles,



WARRING IN THE VOSGES AS FEATURED IN A CENTRAL-STATION WINDOW AT SPRINGFIELD, ILL.

airships and houses were utilized in the display.

Some idea of the indirect value of this form of advertising can be obtained from the fact that A. D. Mackie, vice-president and general manager of the company, claims that the window display was the most attractive one ever shown in Springfield. Standing room in front of it was at a premium and the local papers published pictures and descriptions of it. The display will be used in every one of the seventy-five towns in the United States where the Hodenpyl-Hardy syndicate controls utilities.

Montana State Hospital to Install Biggest Electric Range

A 30-ft., eight-oven Simplex electric range has been sold through the Montana Power Company of Butte to the Montana State Hospital at Warren Springs, Mont. This range is to cook the meals for from 1200 to 1500 persons daily and is believed to be the largest of its kind in the world. A similar but smaller range now does the cooking for 1000 persons daily at the Southern Indiana Hospital for the Insane at Evansville, Ind.

To Install Concentric Wiring in Louisville Residences

On his return from the meeting of the wiring committee of the National Electric Light Association, of which he is a member, Robert Montgomery, manager of the commercial department of the Louisville Gas & Electric Company, announced that he had ordered material sufficient to wire a number of Louisville houses on the concentric system. The experiment is being watched with interest by the electrical contractors of the city, and it is expected that the work will be completed some time in November.

How to Capitalize Your Show-Window Space at Hallowe'en Time

One of the most valuable assets of the electrical store is its show window. Tying the display in the window up to Hallowe'en will convert it into a "business-getter" for this period. All that is required is a few jack-o'-lanterns, some shocks of cornstalks, and some appropriate placards. Flashing lamps in the jack-o'-lanterns will do much toward increasing the value of the display. One of the accompanying suggestions for attracting trade at Hallowe'en was submitted by the Lancaster (Pa.) Supply & Construction Company to the National Lamp Works, and the other is suggested by the Edison Lamp Works.

Reaping the Explosion—How a Motor-Service Contract Was Closed Forty Minutes After the Boiler Let Go

A recent boiler explosion in a flour mill and grain elevator at Columbus, Kan., brought a power contract to the Empire District Electric Company—a contract

A PROSPECTIVE MOTOR-SERVICE CUSTOMER AT COLUMBUS, KAN.

which long, consistent pressure by the company's salesmen had not been able to secure. "Of course it was the old, old story," says F. C. Arthur, local manager. "The old kettle had been only twenty-five years in service and had never given any trouble except that it was leaky, but that was due to the numerous patches on it. The fact that boiler insurance on it had been denied was attributed to the ignorance of the inspector —besides, it never had blown up before."

And yet it did blow up, and by a very narrow margin a serious accident was avoided. The fireman had just left the room, and a "Frisco" passenger train which had stood on a siding only 30 ft. away had just pulled out.

Forty minutes after the explosion occurred Mr. Arthur had secured the contract for electric power and for complete motor equipment. The mill was shut down for only two days, a fact which saved the customer much money as the new wheat was just coming to the elevator.

Such an experience and such a photograph give evidence of far more weight than many words and may be utilized to good effect in many situations when the presentation of mere statistics fails to convince the prospective customer of the superior advantages of electric drive over the older systems.

ELECTRIC JACK-O'-LANTERNS ARE FEATURES OF THESE TWO HALLOWE'EN WINDOW DISPLAYS

Display Advantages of an Appliance Showcase with Sloping Front

Directly in front of the door in the main offices of the Greenfield (Mass.) Electric Light & Power Company stands a plate-glass appliance showcase with a sloping front. Every visitor to the premises must pass within a few feet of this attractive display in

APPLIANCE SHOWCASE AT GREENFIELD, MASS.

order to enter the room, and the departure from the ordinary rectangular shape or the usual wooden-counter style of exhibition furniture adds a degree of attractiveness which is only hinted at in the accompanying view. The case measures 26 in. wide at the bottom and 14.5 in. wide at the top; it stands 4 ft. 2 in. high, and it is equipped with five plate-glass shelves and a marble base with a green felt covering. Filled with polished electric utensils, the case is, in the words of one customer, "almost inescapable as a silent salesman."

Motor Drive for the Old-Fashioned Ice-Cream Freezer

The method of drive illustrated herewith may appeal to some ice-cream makers who adhere to the practice of freezing ice cream in the old-fashioned way, with revolvable paddles and cans set in tubs. The tub is connected with a brine-circulating system, refrigeration of the freezing solution being afforded by the electrically driven compressor shown on the right-hand side of the picture. The motor driving the ice-cream freezer is connected with the can and paddle through reduction gears and the angle transmission shown. The chucks gripping the can and paddle can be raised by a lever when the can is to be removed. This arrangement can be extended to drive several freezers. The installation shown is the property of a customer of the Philadelphia Electric Company.

FREEZER ADAPTED FOR GEARED MOTOR DRIVE

"Company Day" at Easton, Pa.

The first of a series of "company days" for the heads of departments of the Pennsylvania Utilities Company, Easton, Pa., was observed at Easton recently. The occasion turned out, in a measure, to be a "getting-acquainted" day for the vice-president and general manager of the corporation, William D. Ray. Mr. Ray has been in charge of the Pennsylvania Utilities properties since their acquisition by the W. S. Barstow & Company interests early in June, but has been so busy getting his organization into shape that he has had little time to become acquainted with the business men of Easton and the other towns served by his company. So, when the heads of the various departments were called together for a day of conference, the business and professional men of Easton seized the occasion to welcome him as a citizen and to become better acquainted with him. This was made possible by the fact that invitations had been sent to many people outside of the organization to hear an address by H. L. Fogelson of Chicago at the evening session.

In the morning the officials and heads of departments met in the office of Mr. Ray for a general conference, and in the afternoon a program of papers and addresses on company subjects was heard and discussed.

A Simple "Sticker" Which Sold 160 Irons

The Watertown Light & Power Company, Watertown, S. D., effected the sale of 160 electric irons during two summer months, using stickers such as that illustrated pasted over the face of its bills. Two types of high-grade irons, the regular prices of which were known to its customers, were offered at the price of $2. As Watertown is a town of about 9500 inhabitants, no outdoor salesmen are employed, the company making all sales directly from its office. Considering the fact that the company already had about 750 irons on its circuits, the results obtained from this inexpensive form of advertising were considered more than satisfactory.

GUARANTEED
ELECTRIC FLAT IRONS
$2.00
$2.00
Why endure the drudgery of ironing with an ordinary flat iron when you can have an ELECTRIC Iron for $2.00.
THE ELECTRIC LIGHT CO.
PHONE 2433

STICKER ATTACHED TO CUSTOMER'S BILL

Electrically Heated Japanning Ovens

Data on Their Construction and Operation Presented by C. F. Hirshfeld and W. D. Dygert Before Recent York Cliffs (Me.) Convention of Sales Managers of the Larger Edison Companies

THE introduction of electrically heated japanning ovens has opened up a field of great interest to the central-station industry. These ovens are individually large consumers of energy, each oven representing a demand of from 75 kw. to as high as 250 kw. When properly operated, they have a high intrinsic load-factor. In most plants they can be so operated as to make a minimum demand, or even zero demand, at the time of station peaks. If it can be made financially worth while, many industries can throw them on the line at night only. Detroit's industries, for example, operate so many japanning ovens that if all were electrified their demand would equal about one-half of the present day load.

Electric japanning has emerged from the experimental stage. This fact, taken with the condition that if proper caution is used such electric-heating business can be added with little fear of unsatisfactory results and costly experimental installations, materially adds to its attractiveness.

Advantages of Electric Heating in Japanning Work

Japanning consists of two distinct steps: first, the covering of material with a pigment-bearing liquid known as japan, and, second, the setting or solidification of this covering by baking at a temperature generally between 350 deg. and 450 deg. Fahr.

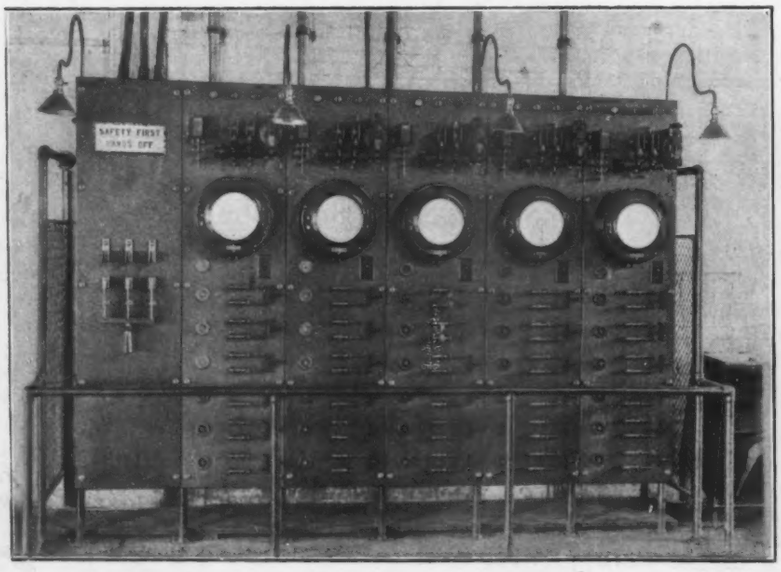
The hazards of heating japanning ovens by gas are well recognized in the industry, a fire in an oven being taken as part of the daily routine in many plants, and explosions being an ever-present or oft-recurring menace.

When electric-heating units are properly chosen and properly installed they operate at such low temperature that they are below the flash point of the volatile oils used in the japan, and there is therefore practically no danger of fire or explosion. This in itself would go far toward creating a demand for electric heat if the latter possessed no other advantages. Fortunately, however, electric heating offers many other benefits, and they are so evident that there is little difficulty in convincing prospective customers of their real and monetary value.

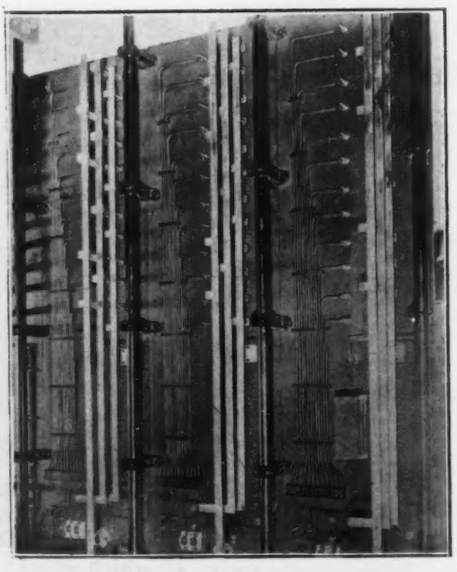
The important arguments in favor of electric heating of japanning ovens are:

1. *Control of the Atmosphere Surrounding the Work.*—In gas-heated ovens the heated products of combustion bathe the work on their way to the offtake or stack. The atmosphere surrounding the hardening japan is therefore determined entirely by the composition of the gas burned, the amount of air supplied for combustion, and the amount of additional ventilating air which enters the oven by leakage or intent. With plain black work the effect of this atmosphere is not generally noticed until the product of a gas-heated oven is compared with that obtained from an electrically heated oven. It is then very obvious that the gas-fired product is dull and spongy in comparison. In the words of the japanner, it lacks "life." Many colored japans cannot be fired successfully in the common forms of gas-fired oven because of the discoloration resulting from reactions between the pigments and the products of combustion. Obviously all of these troubles disappear in the electric heating. The work is always baked in pure air or air mixed with the vapors given off during baking, and the relative proportions can be controlled by regulating the rate of ventilation.

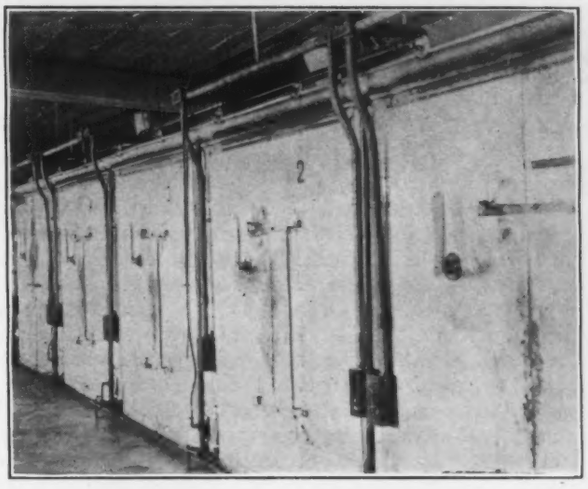
2. *Safety from Fire and Explosion.*—While it is true that the design of gas-fired ovens can be improved in such ways as to remove open flames and red-hot metal surfaces from the japanning space of the oven, such construction is far more costly, gives lower thermal efficiency, and materially increases the danger of an explosion of gas and air in the space containing the burners. It must also be admitted that electric heating can be so done that it is as dangerous as gas heating. Improper installation leading to short-circuits, arcs or sparks may lead to disastrous results. Similarly, heating units which operate at excessively high temperatures, or which burn out, may be just as dangerous as open flames. Great caution should therefore be used, particularly with the earlier installations, and persons who are not acquainted with the electrical properties of



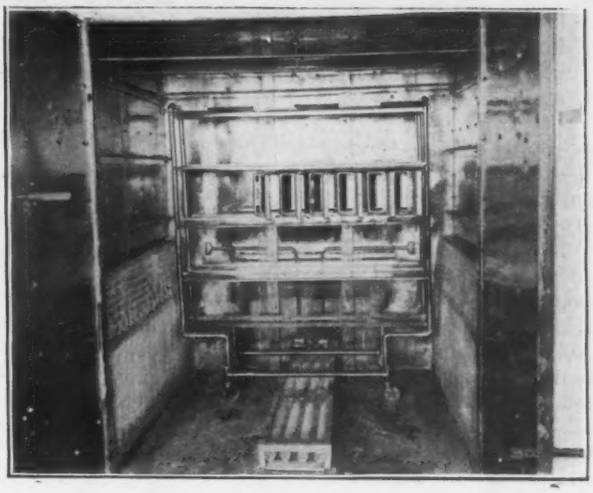
CONTROL PANELS FOR FIVE ELECTRICALLY HEATED JAPANNING OVENS



REAR VIEW OF THREE OVEN-CONTROL PANELS



A ROW OF ELECTRICALLY HEATED JAPANNING OVENS



OVEN HEATED WITH OLD TYPE OF RESISTOR UNITS

materials at temperatures between 600 deg. and 1000 deg. Fahr. should seek advice from those who have had occasion to acquire such knowledge before making commercial installations.

3. *Control of Temperature and Rate of Heating.*—With electric heating it is naturally possible to obtain perfect control in a very simple and fool-proof way. To this more weight has probably been given than it has deserved, because such work as has been done indicates that the japanning process is not very sensitive. Within very wide limits the rate of heating and the way in which the temperature is varied do not seem to make great differences in the quality of the product. It does seem probable, however, that, as the industry develops further and as more accurate studies are made in electrically controlled ovens, it will be discovered that there is some best way of baking each japan on each different kind and size of piece.

4. *Increased Production.*—Experience has shown that work can be brought up to temperature much faster without damage to the japan in an electric oven than it can in a gas-fired oven. In some cases it has been held that a reduction of 50 per cent in the time of baking could be effected, but this is probably an exorbitant claim. Experience has also shown that there are fewer losses in the electrically heated oven; that is, fewer pieces must be rubbed down because of imperfections, redipped and rebaked. These two facts tend to increase materially the output of a given size of oven over what is possible with gas firing. The capital invested per unit of production is thus materially reduced.

5. *Reduction of Labor Cost.*—Since there is smaller loss with electric heating, less labor is required for rubbing down and reworking imperfect material. Actual experience has shown that this may be a very important consideration, particularly in plants which maintain a high standard of quality.

Meeting Objections to Electric Operation

The argument commonly used against electric heat is the high cost of heat obtained in this very indirect way. It must be admitted, when cost of energy on a thermal unit basis is the only consideration, that energy received over wires appears at a great disadvantage. But this is only a very small part of the story. The advantages already enumerated actually have such great commercial weight that they overbalance in most cases the higher cost of thermal units. In this connection it should also be noted that a direct comparison on a basis of thermal unit cost is not justifiable because of the different efficiencies at which energy is utilized when received in the two different ways. With electrical heating practically all of the delivered energy is liberated in the oven and may be absorbed there, while with gas heating this may be far from true.

Industrial experience and conclusions are, in the end, the court of last resort. It is therefore interesting to note that, to the authors' knowledge, no manufacturer who has tried electrically heated japanning ovens during the last few years has returned to gas heating. On the contrary, all have remained highly enthusiastic over this method, despite the fact that many of them had to pay rather heavily for the imperfections of the earlier apparatus and installations.

Ovens are commonly made of light-gage sheet metal properly stiffened with angles and channels. The walls and roof are generally double and the space inclosed is filled with heat-insulating material. Sufficient data are not yet available to make it possible to say just what kinds or thicknesses of insulating material are best, but some information can be given.

Selection of Insulating Material

Insulating material in powdered or flake form should not be used because it has a tendency to settle with repeated changes of temperature. The inner wall of the oven naturally attains a temperature near that of the interior, say, 400 deg. to 450 deg. Fahr. The outer wall of a properly insulated oven has a temperature from 250 deg. to 350 deg. lower; the hand can be very comfortably held in contact with it. Under such circumstances the metal forming the inner wall must bulge in order to expand as it is heated, and the constant bulging and straightening out appear to work the powdered forms of insulation until they fill up previously existing voids. Fibrous material is probably better, although not by any means perfect, since the constant working must break it down in time.

Insulating material in the form of a fairly hard block or sheet seems to be best. Magnesia block seems to be a little too soft to stand such constant working and exhibits its well-known tendency to flow.

The use of solid material is more costly than the use of loose powder or flakes, because it has to be fitted into the walls of the oven, and this involves a high labor charge if properly done. It is believed, however, that this is justified by the results achieved.

From such data as are now available it appears that the insulating material should have a thickness of from 2 in. to 3 in. when in block form and inclosed between two metal walls.

When ovens are set side by side so as to form a solid

bank, it is often customary to use thinner insulation in the dividing walls than is used in the outside walls. Such practice is justifiable if all of the ovens are to be maintained at a high temperature at the same time, but this is practically never the case. One oven is generally loaded and unloaded while its neighbors are baking, and the dividing walls should therefore generally be considered equivalent to outside walls.

It is also very important to reduce to the absolute minimum the amount of metal connecting the inside and outside walls of the oven. The conductivity of wrought iron and mild steel is about 1400 times as great as is that of good insulating material. A channel of 0.125-in. metal 8 ft. long, such as might be used in stiffening an oven, would therefore conduct about as much heat to the atmosphere as would 10 sq. ft. of insulated wall. A harmless-looking 0.25-in. bolt has a conductivity almost equal to that of a square of insulated wall 7 in. on the side. Such facts are often apparently lost sight of, and there is much chance for improvement in oven design in this respect.

Reconstructing Gas-Heated Ovens

Old gas-heated ovens of comparatively poor construction have been equipped for electric heating in some cases when the expenditure required for purchasing new ovens could not be justified. These ovens have been made to give satisfactory service by inclosing them in a case of insulating brick, laid up tight to the outside of the old oven and plastered over on the outside to decrease air circulation and consequent heat losses.

Another fruitful source of loss is the door. A properly designed oven should have a door, or doors, opening up the full width and height of the oven to facilitate loading and unloading. Such doors are large and heavy, and it is difficult to support them so that they will not sag and bend unless expensive construction is used. It is also difficult so to design them and the latches which hold them closed that they will remain tight while the oven is in operation. They generally permit the inflow of enormous quantities of cold air and the outflow of great volumes of most irritating smoke. A moderately expensive door construction is warranted, and much thought can advantageously be given to the development of a design which will permit of free expansion and contraction, so that the door will not have to warp or bulge when the oven is hot.

Energy can also be greatly conserved by proper operating methods. The heating of a cold oven calls for the expenditure of a quantity of energy comparable with that required to heat the material being japanned and to cause the necessary changes in the japan. Obviously, therefore, it is not advisable to operate in such a way that the oven walls will be allowed to cool down appreciably after each bake.

Economical Loading of the Ovens

The simplest method of preventing unnecessary cooling in the ordinary types of ovens is to provide wheeled frames of light construction for supporting the work. These can be loaded outside of the oven, and when the latter is opened the frame load of finished product can be wheeled out and the frame of raw product wheeled in. Some japanners claim that this is impossible because work must be loaded while it is still dripping. They contend that if the japan is permitted to take what might be called an initial set and is then handled or jarred, the coat will be damaged in such a way as to cause a sort of watering or crazing. This may be true under some conditions, but the fact that some plants do actually load and unload in this fashion and that they do turn out a satisfactory product would seem to indicate that the method is capable of giving good results when properly handled.

When a number of ovens are installed in one plant it is sometimes possible to approximate a high load-factor by operating the ovens serially, arranging the process so that a given number will always be on the line at one time, with a proper number off for loading and unloading.

Computing Energy Required

One of the problems faced by the salesmen in this field is the determination of the rate at which heat will have to be liberated in a given oven or for a given amount of japanning. It is generally safe to assume that one coat of japan can be baked on from 9 lb. to 12 lb. of metal by the expenditure of 1 kw.-hr. Much better results are obtained in many cases, but first approximations should be based on these figures. The lower figure may be assumed to hold in the case of very heavy metal parts with small exposed surface; the larger figure may be taken as applying to parts made of very thin metal with a great extent of surface. By far the larger part of all the energy supplied is used in heating the oven, the metal and the ventilating air, a minor part being actually used in the production of the process.

Another very useful method of making approximate calculations is based upon the external radiating surface of the ovens. Experience has shown that, with average oven construction and with processes worked at maximum temperatures of about 400 deg. to 450 deg. Fahr., about 100 to 110 watt-hours are used per square foot of external radiating surface, including the floor.

Advertising the Christmas Club Electrically

The Cosmopolitan Trust Company, in Boston, has hit upon a new application of the electric sign as shown in the accompanying picture. To advertise its Christmas Savings Club, the lower part of a window has been set aside for an artistic sign in which miniature electric lamps have been used for decorative purposes. The sign consists of a 4-ft. by 6-ft. mat on which holly trees are painted, with the berries simulated by sixteen miniature ruby lamps on each tree. In the center panel of the sign thirty miniature, clear lamps are used as a border to give prominence to the Christmas Club announcement, and a painted holly wreath, studded with eight red lamps, gives a further spot of color to the display. The sign is kept burning daily from dusk until 7 p.m. on the service of the Edison Electric Illuminating Company of Boston.

W. H. JOHNSON

Walter Howard Johnson, the president-elect of the Electric Vehicle Association of America, is first vice-president of the Philadelphia Electric Company and has been engaged in central-station work in Philadelphia for twenty-eight years. Mr. Johnson's early business experience was obtained in the local mercantile field, and before entering the electrical business he served for a time with the Philadelphia, Wilmington & Baltimore Railroad and later with the Pennsylvania Railroad. It was in 1887 that Mr. Johnson first joined the staff of the old Edison Electric Light Company of Philadelphia, subsequently becoming secretary of that corporation. The Edison company was later acquired by the Pennsylvania Heat, Light & Power Company, and it in turn came under the control of the Pennsylvania Manufacturing, Light & Power Company in the year 1898.

W. H. Howcroft, formerly district superintendent with the Washington Water Power Company at Harrington, Wash., has resigned to go into the electrical contracting business at Ticonderoga, N. Y.

M. Montpellier, editor-in-chief of *L'Electricien,* Paris, France, has been nominated to the grade of chevalier of the Legion of Honor. At the outbreak of war M. Montpellier entered the service as chief of section of the central military telegraphs at Paris.

J. H. Shearer, formerly general superintendent and contract agent of the Cambridge Gas, Electric Light & Power Company of Cambridge, Md., has been appointed general superintendent of the Salisbury Light, Heat & Power Company of Salisbury, Md., which company has recently come under the ownership of Day & Zimmerman of Philadelphia.

L. W. Anderson, who has been an employee and official of the Plume & Atwood Manufacturing Company of Waterbury, Conn., for the last twenty-eight years, has resigned as manager of the fixture-part department of the company, which manufactures electric-lighting fixtures. Mr. Anderson has been a prolific inventor, and a number of United States patents have been granted to him.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Dana H. Howard, superintendent of the advertising department of the Commonwealth Edison Company of Chicago, addressed the Des Moines Admen's Club at luncheon on Oct. 12. He illustrated the value of different methods of advertising, displaying lantern-slide pictures. Mr. Howard declared that it is as necessary for the seller to advertise as it is to have goods to sell.

Algernon Robert Cheyney, until recently superintendent of operation of the Philadelphia Electric Company, with headquarters at the company's Christian Street plant, a position which he was compelled to resign on account of serious illness due to overwork, is now at St. Petersburg, Fla., where it is hoped that he will before long recover his normal health and strength. Mr. Cheyney has been associated with the Philadelphia Electric Company for the last eighteen years. He is a fellow of the A. I. E. E. and past-chairman of the Institute's Philadelphia Section.

J. E. North, who was recently appointed chairman of the Ohio Electric Light Association committee on new-business co-operations, which each year holds a program of meetings for the discussion of central-station commercial problems, is the manager of the

J. E. NORTH

commercial department of the Springfield (Ohio) Light, Heat & Power Company. Mr. North first entered electrical work in 1903 with a local traction company, and was later appointed electrical engineer of the road. In 1908, following a receivership and reorganization of the traction company, Mr. North joined the force of the Robbins & Myers Company of Springfield, and in 1909 he joined the commercial department of the Springfield company, becoming its head in 1910.

T. A. WYNNE

Thomas A. Wynne, who was last week elected Jupiter of the Jovian Order, is vice-president and general superintendent of the Indianapolis (Ind.) Light & Heat Company. Mr. Wynne was formerly Jovian statesman for Indiana, and as such has been in charge of the local highly successful Jovian activity. As chief engineer for the Indianapolis company Mr. Wynne has been responsible for much important engineering work on the local system, including the planning of turbine extensions to the company's main generating station, the installation of storage-battery auxiliaries and the construction of a great subaqueous coal-storage pit.

R. B. Stichter, general manager of the Texas Traction Company, Dallas, Tex., and a past-president of the Southwestern Electrical and Gas Association, has been in Colorado on a prolonged vacation to recover his health, following a recent breakdown caused by overwork. Mr. Stichter expects to return to Dallas the latter part of October.

J. J. Rockwell has rejoined the staff of the McGraw Publishing Company, publisher of the ELECTRICAL WORLD, in the capacity of advertising counselor to that company and its customers, and will make his headquarters at the company's general offices in New York City. Since Mr. Rockwell's previous association with the McGraw Publishing Compand (during the years 1910 and 1911) he has been engaged in the advertising-agency business in Chicago in connection with the Crosby-Chicago Advertising Agency. In earlier years he was associated with the Mahin Advertising Company and the Long-Critchfield Corporation, both well-known advertising organizations in Chicago, and he is well known in advertising circles throughout the country. His work as an advertising expert has frequently excited highly favorable comment, and his long experience in the general-agency business, as advertising manager, in publishing fields, and as counselor for advertisers in many lines of business, with his special and unusual experience in industrial and technical fields, should enable him to be of peculiarly valuable service to the McGraw Publishing Company and its customers.

Technical Advance in Theory and Practice

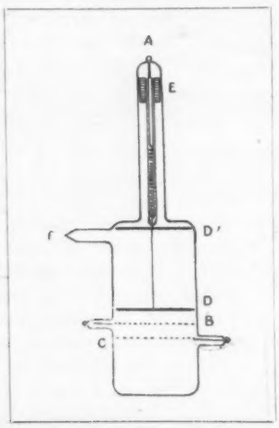
Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

A PHOTOELECTRIC RELAY

Tube with Aluminum and Wire-Net Electrodes Sensitive to Light—Application to Detection of Electromagnetic Waves—Use as Telephone Relay and Thermostat

BY JAKOB KUNZ

The sensitive photoelectric relay illustrated herewith, which may be used for various scientific and technical purposes, consists of a glass tube 6 cm. in diameter and 19 cm. in length, in which the aluminum plate D' can be moved toward the wire net B by means of a magnet acting on the iron cylinder E. A little rubidium is distilled in the vacuum through the side tube F on the plate D', which in this way can be uniformly covered with the alkali metal. Hydrogen will then be admitted and the surface of the alkali metal rendered sensitive by means of the glow discharge. The hydrogen will be replaced by argon until the sensitiveness is a maximum. The light of an incandescent lamp at a distance of 50 cm. passes through the two wire nets B and C and



SENSITIVE PHOTOELECTRIC RELAY

liberates the electrons in the position D from the rubidium-hydrogen. These electrons move under the influence of a small potential difference from D to B, where they enter the electric field between C and B, which is so strong that ionization by collision takes place. Through this process the current between B and C becomes very large. The currents between DB and BC can be varied within wide limits by a variation of the pressure and of the distances between the electrodes.

In the course of experiments conducted in the physics laboratory of the University of Illinois, Urbana, the distance between B and C was kept constant, about 5 mm., while the distance between D and B was varied from 3 mm. to 30 mm. The primary or photoelectric current between D and B varied from 3×10^{-10} to 10^{-7} amp., and the secondary or ionization current from 10^{-7} to 10^{-5} amp. The maximum secondary current was sufficient to close an ordinary relay. The secondary voltage required for the maximum current was 136 volts. A further increase of this tension produces a glow discharge which persists even when the primary current is interrupted. This apparatus thus acts as a relay, a weak primary current closing the circuit of a relatively strong secondary current.

Following are additional uses established by experiments made with this apparatus in the laboratory:

(1) Energy of collision. Distances of 2 mm. or 3 mm. between the wire meshes and 20 mm. to 30 mm. between D and B were chosen, and a retarding potential difference was applied between C and B and an accelerating potential difference applied between D and B. The current between C and B was then studied as a function of the potential difference between D and B. A maximum in these curves was found from which it is possible to determine the amount of work required to produce an ion in alkali vapors by collision.

(2) The reversed photoelectric effect. The photoelectric effect consists in the transformation of the energy of radiation into the kinetic energy of an electron. The reversed effect consists in the transformation of the kinetic energy of electrons into light. If a beam of monochromatic light is directed from a side tube on the sensitive surface D, and the electrons accelerated between C and B so that ionization by collision occurs with the emission of light, then it might be inferred from measurements made by J. Franck and G. Hertz in mercury vapor that resonance light will be emitted by the alkali vapors as determined by the equation

$$e \triangle p = \frac{1}{2} mv^2 = hn.$$

Here is a new possibility for the determination of h. If this constant of radiation could be determined by vapors, it would be established that h is an atomic constant and not a constant of molecular structure. In the preceding two applications no argon is used.

(3) Photometric measurements.

(4) The detection of electromagnetic waves. The apparatus is already more sensitive than the neon tube which is often used as indicator in wave meters.

(5) A telephone relay for weak electric currents.

(6) A thermostat for the regulation of temperature within a very small fraction of a degree.

(7) A light sensitive relay. In lecture experiments performed by means of this relay a beam of light has been made to ring a bell or to turn on a group of incandescent lamps.

Generators, Motors and Transformers

Direct-Current Motor-Speed Regulation by Resistance in the Armature Circuit and the Use of Diverters.—THOMAS CARTER.—The first part of an article which, after indicating the conditions of speed regulation under which the use of resistance in the armature circuit of a motor may be considered advisable, and pointing out the accompanying disadvantages as regards low efficiency and instability of speed, proceeds to consider the conditions under which diverter resistance may be usefully employed in addition to ordinary series resistance. The "diverter" is a resistance placed across the armature terminals so that the diverter and the armature form a loop in series with the original series resistance. The combination is of the nature of a "potentiometer," with the armature tapped off across a part of the resistance. There is an initial value of the diverter resistance, greater than zero, which is required merely to keep the armature turning round. This is

due to the fact that the motor has a certain amount of internal resistance. In Fig. 1 the diverter is shown with a permanent part corresponding to some minimum speed below which it is not required to go, and a variable part, with a range shown by the distance between the two limiting positions of the sliding arm, the travel

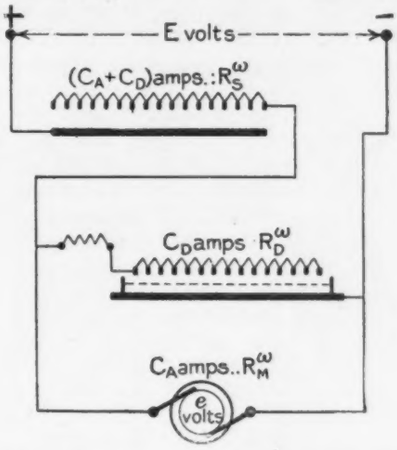


FIG. 1—ARRANGEMENT OF DIVERTER IN REGULATION OF DIRECT-CURRENT MOTOR SPEED

of which is shown by a dotted line. This variable part is used for gradually increasing the speed, when required, up to the point when the diverter is cut out altogether and the armature runs with series resistance only in circuit. After this point the speed is further increased up to the normal by cutting out series resistance. The subject is investigated mathematically and graphically. N is the motor speed with full volts E at its terminals and full field strength, and n is the speed

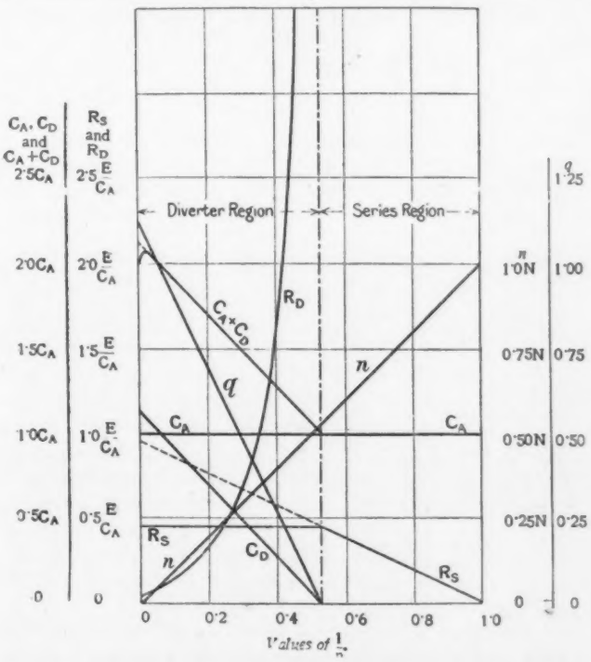


FIG. 2—RELATION OF VARIABLES DURING STARTING AND RUNNING OF MOTOR USING DIVERTER

under any other conditions. p equals N/n. Let C_a be the armature current, C_d the current in the diverter resistance, and $C_a + C_d$, in consequence, the current in the series resistance. Let the internal resistance of the motor armature, and any series windings there may be, be R_m, R_d the value of the diverter resistance, and R_s that of the series resistance. Let e be the back emf. of the armature corresponding to the speed n. Let the internal lost volts in the motor be l times E, i.e., let C_aR_m be lE. Let $C_d = qC_a$, so that the current in the series resistance is $(1 + q)C_a$. Let the initial current required to overcome the "stickiness" of the machine and just produce motion be $(1 + r)C_a$. Further, it is assumed that $r = 1.0$ (i.e., the motor takes 100 per cent overload in current at starting) and $l = 0.5$ for full load. For these conditions Fig. 2 shows the result of plotting the dependent variables against $1/p$, and from such a diagram the values of R_d and R'_s can be found for any specified value of $1/p$. It will be noted that q follows a straight line, and R_s goes down to zero in a straight line which, produced backward as shown dotted, cuts the zero ordinate at $0.95E/C_a$, i.e., at $(1 - l)E/C$, which is the value of R_s required when $r = 0$. It is interesting to note in passing that the diverter region shrinks in width as r becomes smaller, and that should r be zero—i.e., should the starting and running currents be the same—no diverter is required at all, as a gradual increase of speed from zero to maximum is possible by the use of R_s alone. Diverter resistance is therefore increasingly useful the greater r is. The article is to be concluded.—London *Electrician*, Oct. 1, 1915.

Lamps and Lighting

Rating Incandescent Lamps.—J. EPSTEIN.—The author favors the new practice of designating incandescent lamps by watts, but thinks this is not sufficient. He would not add the number of candles, however, but prefers to give the lumens, because the ratio of lumens to watts has a distinct physical and technical meaning. For instance, the ordinary 32-cp. lamp consumes 1 watt per candle. It therefore consumes 32 watts, while its horizontal candle-power is 32 cp., the spherical candle-power is 32×0.8, and the total lumens therefore $32 \times 0.8 \times 12.5 = 32 \times 10$. The ratio of lumens to watts ("ausbeute," or specific output) is therefore 10, and it will be seen that this ratio of lumens to watts can be expressed by whole numbers within sufficient limits of accuracy for all modern lamps. This ratio is a characteristic figure, as it indicates the efficiency of the lamp. The larger this ratio the better the quality of the lamp with respect to efficiency. The author recommends that the 32-watt lamp be designated by 32 watts × 10. Even laymen would soon learn to understand the meaning.—*Elek. Zeit.*, July 8, 1915.

Generation, Transmission and Distribution

Electricity Supply and the German Government.—G. SIEGEL.—While in the past electricity supply has been carried out by privately owned corporations and by municipalities, larger districts in Germany, such as counties, have already taken a financial interest in large transmission systems, and the question is now discussed whether after the end of the war the whole electricity supply should not be taken over by the German government in order to procure new revenues. The present author thinks that the best the state could do would be to erect large power plants at suitable coal mines or peat deposits or by development of water-powers. The state could operate these power stations, which would be connected together by high-tension transmission lines, energy being given off at certain points to large transformer stations. The further distribution of energy should, however, be left to the present private corporations.—*Elek. Zeit.*, Aug. 19, 1915.

Reciprocating Electric Tools.—A note on a recent British patent (No. 19,322, 1914) of J. W. Mackenzie and the International Electric Tool Company of this country for electric hammers, etc., in which the reciprocating plunger is actuated by two solenoids. Both

solenoids are supplied with a permanent continuous current, and also by means of separate terminals with an alternating current which reinforces the field of one and neutralizes the field of the other, so that the solenoids at each end are energized alternately. The continuous and alternating currents are obtained from a special generator provided with both commutator and slip-rings.—London *Elec. Eng'ing*, Sept. 30, 1915.

Traction

British Tramway Problems and the War.—An account of the proceedings of the annual conference of the (British) Municipal Tramways Association. James Dalrymple read a paper on tramway labor problems as affected by the war, with special reference to the city of Glasgow. Many of the motormen and conductors have enlisted and women conductors have been employed with good success. He thought that the employment of women was the only solution of the labor problem so far as the traffic staff was concerned. There was an extended discussion, and almost all speakers agreed that women conductors were satisfactory. A. Baker of Birmingham read a paper on financial problems as affecting British tramways during the war, which was also discussed at considerable length.—London *Electrician*, Oct. 1, 1915.

Installations, Systems and Appliances

Petrograd.—J. Vichniak.—On the basis of a paper by M. Makarieff before the sixth Russian Electrical Congress the author gives a summary of the development of electric central stations in Petrograd. Most of the generating plant at present consists of turbo-alternators, the mean rating being 6200 kw., while the largest machine is rated at 5000 kw. and the smallest at 1600 kw. The total number of turbo-generators in central stations in Petrograd is seventeen, with an aggregate capacity of 44,000 kw. While ten years ago there were four generating stations, there are now only three. An interesting point of note is the repeated change of fuel. In the beginning coal from Cardiff was used, later when the price of oil went down oil was used, but when the price rose again the stations came back to the use of coal. But now, with importation of coal from England to Russia being cut off, some of the stations are thinking of going back to oil.—*La Revue Elec.*, June 4, 1915 (published Aug. 20, 1915).

Wires, Wiring and Conduits

Methods for Making Copper Available in Germany.—Schüler.—Since the production of copper from German mines is not sufficient for the demand for war purposes, the German army has found it necessary to confiscate the copper supplies available throughout the country, and especially is now inquiring at all electric stations how much copper would be available without disturbing the electricity supply and how much copper the stations are willing to sell voluntarily. The present writer thinks that some of the stations could make a virtue out of necessity by changing their supply system. Many stations which have direct-current distribution have long feeders with very large copper cross-section. If these systems were to be replaced by high-tension three-phase transmission to converter stations at the feeder points, large amounts of copper would be made available and the distribution system would be more economical. Further, many stations contain old reciprocating machines directly coupled with generators containing large amounts of copper. These machines are simply kept as "reserve," and are hardly ever used since operation is carried on with steam turbines. As the old generators could hardly be used anywhere else again, the copper might just as well be sold to the army.—*Elek. Zeit.*, July 29, 1915.

Calculating Overhead Lines.—J. Sumec.—The author describes a new and very simple graphical method for calculating overhead lines. The simplicity is due to the fact that, in order to determine the stress in the line wire, only one curve is needed for all distances between poles and for all cross-sections of the same material.—*Elek. Zeit.*, July 1, 1915.

Units, Measurements and Instruments

Roentgen-Ray Tubes.—A note on a recent British patent (No. 21,389, 1914) of the British Thomson-Houston Company and the General Electric Company of this country. The overheating of the target is prevented by making the target revolve by magnetic means in order continually to present a fresh surface.—London *Elec. Review*, Sept. 16, 1915.

Radiology.—J. Blondin.—An illustrated description of some new types of portable Roentgen-ray apparatus. —*La Revue Elec.*, June 4, 1915 (published Aug. 20, 1915).

Book Reviews

Combustion and Smokeless Furnaces. By Joseph W. Hays. Published by the author at Rogers Park, Chicago, Ill. 118 pages, illustrated. Price, $2.

The one part of a steam plant that bears constant watching with best results is the boiler room. Under good conditions, from a dollar's worth of coal fired only about 60 cents' worth of the heat content is effectively used. When conditions seem to be unfavorable to economical operation much of the fault can often be traced to the boiler and its furnace, and the man who should know about the causes and results of this faulty combustion is the one who pays for the coal and is affected most by legislation against smoke. Mr. Hays has appreciated this fact in writing his book and has presented clearly and concisely the laws governing combustion and how they may be observed when using different coals in boiler furnaces. While mechanical stokers, fuel spreaders, pulverized coal burners and the like are discussed, about one-third of the book is devoted to furnace operation with hand firing. The use of mechanical draft, natural draft, steam jets, grate, fire-door, side-wall, bridge-wall and arch air admission are subjects discussed, giving reasons for and against each. As a brief discussion on combustion in boiler furnaces the book will be found, we believe, as the author claims, a help to owners and engineers in arriving at rational conclusions as to feasible devices and improvements necessary for good boiler operation.

Examples in Alternating Currents. Vol. I. By F. E. Austin. Published by the author at Hanover, N. H. 224 pages, 69 illus. Price, $2.40.

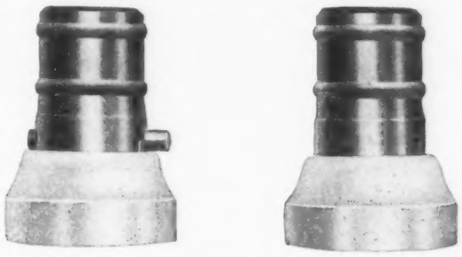
The author of this work has made a very successful attempt to help the student and practical engineer to analyze the theory underlying practical problems and work out for himself certain mathematical solutions. The problems taken up deal with fundamental principles of alternating currents and in most cases are worked out step by step. The book should be very useful to teachers as a class-room text for electrical courses and to engineers as a reference text, since it contains numerous formulas and several useful tables designed to save time in computations.

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

Wall Sockets

The line of 660-watt push-button brass-shell sockets made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has been augmented by the addition of three new types of wall sockets, designated as No. 7550,



FIGS. 1 AND 2—PUSH-BUTTON AND PLAIN WALL SOCKETS

No. 7551 and No. 7561. The brass shells of the last-named sockets and of the fixture and pendent sockets are identical and are therefore interchangeable. The No. 7550 socket is of the push-button type, while the No. 7551 and 7561 sockets are of the plain type without operating mechanism, the latter-named being a short device. Round porcelain bases for concealed work are provided, the supporting screw holes in the bases being spaced 1 in. on centers. The sockets are designed to meet the National Electrical Code requirements at a pressure of 250 volts and a rating of 660 watts.

Chain Screen Doors for Boiler Furnaces

To protect firemen when the fire door of a boiler furnace is thrown open, and at the same time prevent cold air from rushing into the furnace and chilling the highly heated brickwork, the auxiliary chain door shown in the

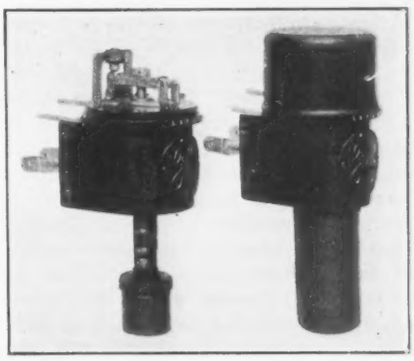
CHAIN SCREEN FOR FURNACE OPENINGS

accompanying illustration has been developed by the E. J. Codd Company, Baltimore, Md. The Wiegand chain door, as it is called, consists of a large number of separate freely hanging strands of small steel chain suspended from a cylinder in a line parallel to its axis. The chains hang sufficiently close together to form a continuous sheet of chain similar to the familiar Japanese door screen.

The cylinder carrying the chain is supported above the furnace opening in suitable brackets. When the fire door is closed the chain is rolled up, and it is automatically unrolled when the fire door is opened. The air that enters the fire box while the door is open must pass through the chains, which break it up into numerous small pencils and cause it to mix thoroughly with the gases from the fire bed, thus promoting, it is declared, instead of hindering, combustion. The chain screen-door arrangement is also very well adapted for use with ovens and furnaces in glass factories and metal and chemical furnaces.

A Relay for Use with Motors Employing Self-Contained Compensator Control

A circuit-opening, inverse-time-limit, oil-dashpot relay has recently been developed by the General Electric Company, Schenectady, N. Y. This relay is designed for use in conjunction with a low-voltage release for automatic, overload and low-voltage protection of alternating-current motors with ratings up to 2500 volts and



OVERLOAD SERIES INVERSE-TIME-LIMIT RELAY

300 amp. It is operated in series with the line, the low-voltage-release coil being connected across one phase in the usual manner with the low-voltage coil in series with the relay contacts. When the voltage drops to a predetermined amount below normal or the overload current is greater than that for which the relay is set the motor is disconnected from the power supply. The relay is designed especially for motors using self-contained compensator control, but it may also be employed in switchboard service when both low-voltage and time-relay overload protection are required. Here series relays replace the secondary relays, current transformers and oil-switch-tripping coils otherwise required. Current calibration is from normal to twice normal, and time adjustment from ten seconds to five minutes on 25 per cent overload. The delay recommended by the mnaufacturer, however, is about fifteen seconds at the starting current of the motor. This delay is said to afford ample protection to the motor against damage from overload or single-phase operation, but prevents the circuit from being opened while the motor is starting. The contact, dashpot and calibrating tube are

inclosed by dust-proof stamped-steel covers. Current and time adjustment are accomplished outside of the dashpot with the aid of a screwdriver. The settings are constant, for an adjusting nut is locked in place after each setting is made.

Electrically Operated Vacuum Pump

For use in connection with "vacuum-pressure" impregnation processes for impregnating electrical field coils, armatures, etc., for condenser plants, and for other purposes where a vacuum is desired, the Ingersoll-

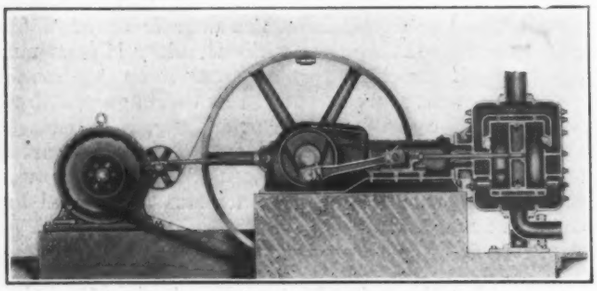


FIG. 1—MOTOR-DRIVEN VACUUM PUMP

Rand Company, 11 Broadway, New York, has recently developed a line of steam-driven and motor-driven duplex-type "Imperial" vacuum pumps as they are called. A sectional view of a motor-driven vacuum pump is shown in Fig. 1. The intake valves are of the Corliss type and are so placed in the cylinder head that the clearance is exceptionally low. On account of the low clearance the manufacturer points out that the air trapped in the clearance spaces at discharge pressure will not reach such a volume upon being expanded to intake pressure as greatly to limit the pressure reduction which may be obtained. The action of the valve is said to be positive and quick and is independent of the cylinder and intake pressures, the pressures within and without the cylinder being as nearly equal as possible. The intake ports are large and in connection with the water jacketing tend to cool the intake gases. The discharge valves, which are of the "direct-lift" poppet type, are in the bottom of the cylinder heads so that any entrained moisture or water is immediately discharged. Clearance at the point of discharge has been reduced

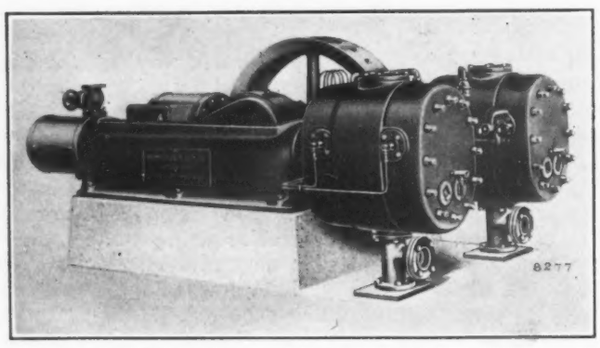


FIG. 2—STEAM-DRIVEN VACUUM COMPRESSOR

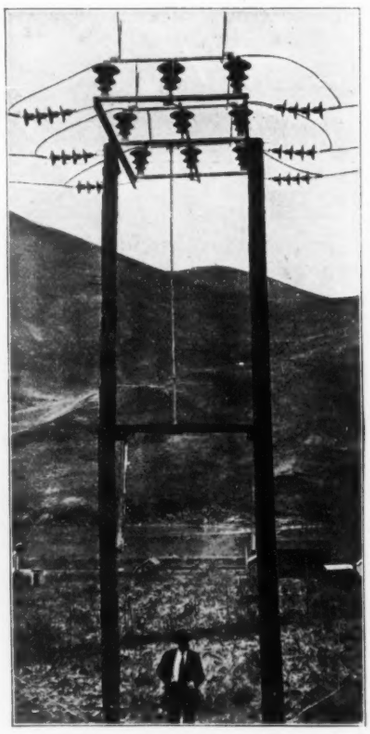
by making the valve partly fill the port in the cylinder head. Both cylinder and heads are completely water-jacketed. The pump is designed to maintain a vacuum within 0.5 in. of barometer. When operating, the flywheel is practically the only visible moving part, yet the entire mechanism is readily accessible while in motion. On account of the duplex construction, should requirements fall temporarily below that for which the equipment was originally installed, one connecting rod can be removed and the operation of one-half the machine discontinued, while the other half operates at its rated speed, displacing one-half the amount of vapor the entire machine is designed to displace. The machines are being built with ratings of from 798 cu. ft. per minute to 7048 cu. ft. per minute, both for atmospheric and low-pressure (5 lb.) discharge.

Flexible Armored Conductor

The Safety-Armorite Conduit Company, Pittsburgh, Pa., has recently developed an armored conductor which is said to be very flexible, is readily stripped, is comparatively smooth on both the outer and inner surface of the armor, and is well galvanized. The conductors are wires of triangular section, the underlying and overlying wires being at such tension that upon flexing the tube the wires are always in contact and do not open so as to expose the insulation of the cable to abrasive influences. The new product is designed to supplement but not to supplant the "Sterling" armored conductor made by the above company from flat strip, the adjacent convolutions of which are interlocked.

High-Voltage, Three-Phase Air-Break Switch

The accompanying illustration shows an installation of a 66,000-volt, three-phase air-break, main-line sectionalizing switch which can be operated from the platform below. With this arrangement a high factor of



6000-VOLT, THREE-PHASE SECTIONALIZING SWITCH

safety is said to be secured, since the locking-type operating handle is permanently grounded and the operator is at a safe distance from the high-voltage lines. All line strains are taken up by the dead-end insulators attached to the steel-channel cross-arms, which in turn support the switch units. The air-break switches employed were made by the Delta-Star Electric Company, Chicago, Ill.

A Disconnecting Switch with Torsional-Balanced Blade

A simple disconnecting switch designed to economize in the matter of insulators, copper, framing and space is shown in the accompanying illustration, as made by the Minerallac Electric Company, 400 South Hoyne Avenue, Chicago, Ill. The switch proper consists of two blades that move in opposite directions. When closing the usual knife disconnecting switch, there is a thrust, which necessitates a support to receive it. On account of the torsional-balanced blades in the switch shown, however, no support is required. By doing away with insulators, leakage of course is eliminated. The switch is operated by a handle, as shown, and is automatically locked in any position. It can be operated, it is said, in a closed compartment through a 1-in. hole. The self-locking feature is obtained by means of geared construction.

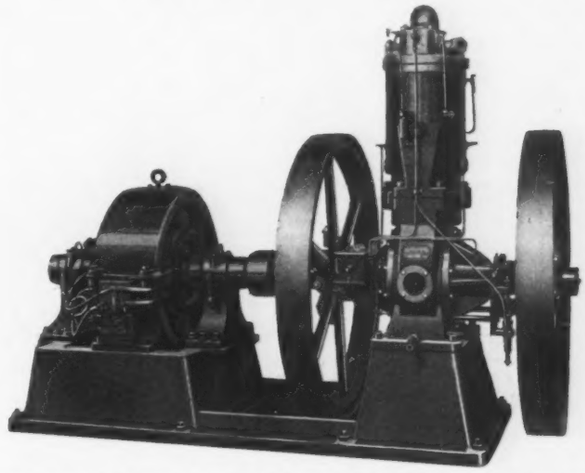
BALANCED DISCONNECTING KNIFE SWITCH

Two-Stroke-Cycle Oil Engine

The oil engine shown in the accompanying illustration is of the two-stroke-cycle type, designed to operate on oil injected directly into the explosion chamber. The crank chamber is entirely inclosed and is used only for pumping fresh air into the cylinder. According to the manufacturer, the Venn-Severin Machine Company, 195 Broadway, Milwaukee, Wis., the method of injecting the fuel insures high economy since disintegration of piston and cylinder walls when using the lighter grades of fuel, such as kerosene and distillate, has been eliminated by proper atomization of the fuel, efficient distribution of air and good combustion.

The method of injecting the fuel is somewhat similar to that of the Diesel type of engine in that injection does not take place until the piston is nearly on dead center on the compression stroke. The vaporizing nozzle consists of a specially constructed valve extending to the center of the combustion chamber and normally held shut by a heavy spring. The fuel in the vaporizing nozzle is heated to a high temperature, and at each stroke of the pump the valve on the nozzle or inspirator is lifted, emitting a cloud of vaporized fuel. In the vaporized condition the fuel is diffused through a charge of compressed air, and ignition takes place instantly.

Pure air is drawn into the crank case when the piston is at its highest point and is compressed by the downward movement of the piston. When the piston passes the transfer port the air rushes into the upper part of the cylinder, displacing the products of the previous combustion which have passed out of the exhaust port before the transfer port opens. As the piston ascends it compresses the charge of air to about 160 lb. per square inch. At this point the fuel is injected into the combustion chamber through the inspirator by a pump actuated by an eccentric on the inertia flywheel governor. The ignition of the charge is affected by the combined heat of the compressed air and of the combustion chamber walls, a torch being required only at starting.



TWO-STROKE-CYCLE OIL ENGINE CONNECTED TO GENERATOR

Connector and Outlet Plate for Armored Cable

A connector for armored cable and an outlet plate equipped with the connector are shown in the accompanying illustration. No clamp or loose pieces are employed which may interfere with the entrance of the cable. For gripping the cable two case-hardened screws are provided. According to the manufacturer, the Sterling Foundry & Machine Company, 98 Chancellor Avenue, Irvington, Newark, N. J., the screws do not obstruct the cable while pushing it in place, while a few turns of a screw sink the head into the cable and effectively prevent it from being pulled out. The "Bi-plex" outlet plate, as it is called, is being made in the straight electric and combination styles. The "Hexel" connector, as

FIGS. 1 AND 2—CONNECTOR AND OUTLET PLATE

it is called, is also provided with a screw for gripping the cable and a lock-nut. Both connector and outlet plates are electro-galvanized.

Hangers for Conduit and Open Wiring

Several types of girder clamps and conduit clips have been developed by the Thomas Wrigley Company of 416 South Dearborn Street, Chicago, to facilitate the work of suspending electric lines from steel beams. The

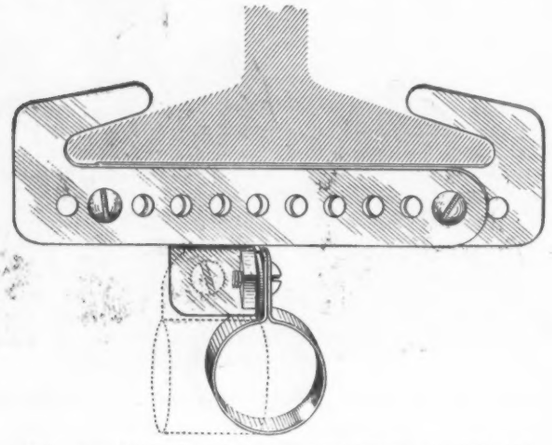


FIG. 1—CONDUIT CLAMP ATTACHED TO I-BEAM

clamps are made adjustable so that they will fit beams ranging in width from 2 in. to 7 in. As indicated by the dotted line in Fig. 1, the clip can be used for conduit runs which are either parallel to or at right angles with the length of the girder.

If the clamps are to be used for supporting wires, they are furnished equipped with a metal cross-arm to which cleats are attached. Where many lines are to be

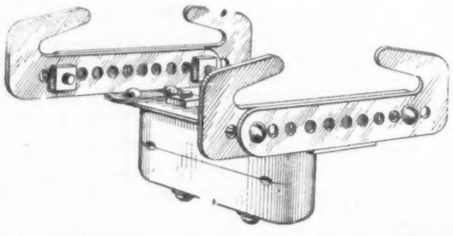


FIG. 2—CLAMP USED WITH CLEAT CONSTRUCTION

strung parallel to each other the metal cross-arms are made of sufficient length to carry the entire number of necessary porcelain cleats.

Electric Cylinder Washer

The washing machine shown herewith is operated by a motor mounted underneath the tub, which is connected by means of helical gears to a revolving cylinder. All worm gears and bearings are totally inclosed and are packed in vaseline, which is said to afford sufficient lubricant for indefinite operation. The washer and wringer can be operated at the same time or separately as desired. The shifting device consists of a worm gear with inserted stud, the shifting operation being performed by means of a gravity lock. The machine is equipped with an instantly reversible wringer by means of which clothes can be either wrung from the washer to the rinse tub, or from bluing water, etc., or back upon the top of the washing machine. An adjustable tub rack is also provided which folds under the machine when not in use. The cylinder may be removed if desired. For cleansing the tub, however, it is only necessary to set the washer in motion and then draw off the water. Use is made of a spigot or faucet, to which a hose may be attached for conducting the waste water wherever desired. The body of the machine is of red

ELECTRIC WASHER WITH ADJUSTABLE TUB RACK

cedar. The washer is being placed on the market by the American Wooden Ware Manufacturing Company, Toledo, Ohio.

Two-Cell Battery-Operated Lantern

In the accompanying illustration is shown an electric lantern which is equipped with a removable bail and a handle and which is operated by two ordinary dry cells. Use is made of a tipless tungsten lamp fitted with a standard candelabra base, and of an all-metal solid-aluminum reflector. The lens is of polished optical glass and is 3 in. in diameter. The switch, push-button, switch pin and switch housing are of solid brass, which

LANTERN OPERATED ON TWO ORDINARY DRY CELLS

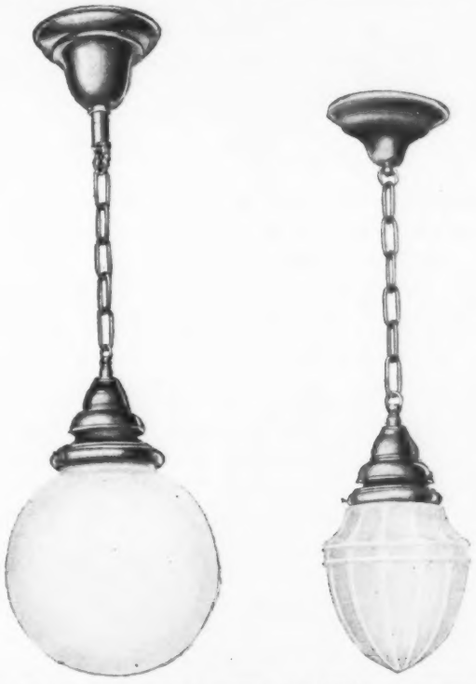
is nickel-plated. The lantern is equipped with a double interlocking switch which prevents the lighting circuit from being opened or closed accidentally. A threaded, milled and beaded lens cap is provided for removing the lens, reflector and bulb. The batteries are inclosed in a heavy-gage reinforced case which is coated inside and outside with thick enamel, baked on. The handle, bail,

lens cap and reflector housing are of solid steel. The lantern is being placed on the market by Hytee's Factories, Inc., Indianapolis, Ind.

All-Brass Fixtures for Nitrogen-Filled Lamps

The F. W. Wakefield Brass Company, Vermilion, Ohio, has recently brought out the all-brass fixtures for nitrogen-filled lamps shown in the accompanying illustrations. Fixtures of the types shown are designed for lamps with ratings up to 500 watts. All the holders are equipped with porcelain receptacles. Finishes are being made in brushed brass and oxidized copper. The holders are ventilated and are provided with medium screw-base receptacles for lamps with ratings up to 200 watts and with "Mogul" screw-base receptacles for the 300-watt, 400-watt and 500-watt lamps.

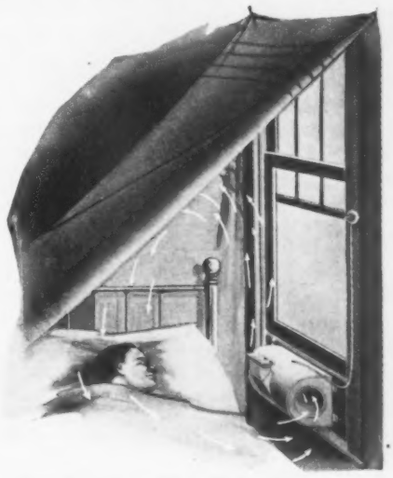
FIGS. 1 AND 2—5-IN. AND 6-IN. VENTILATED HOLDERS FOR 200-WATT LAMPS



FIGS. 3 AND 4—UNITS WITH ALL-BRASS VENTILATED HOLDERS

Electric Window Ventilator

A small motor-driven ventilator which may be fitted in a window as shown in the accompanying illustration has recently been developed for use in offices, hospitals and residences. The device is especially valuable for use in winter when it is desired to close the doors and windows. Two fans are provided which are connected to a Racine universal motor. One fan is employed to force the fresh air into the room while the other is utilized to draw out the impure air, causing a continual current of air in the room as indicated by the arrows in the illustration. The motor frame is covered by a molded-cork sound deadener, which, according to the manufacturer, makes silent operation possible. The ventilators are being made in three sizes by the Hackney Ventilating Company of Minneapolis, Minn.



MOTOR-DRIVEN TWO-FAN VENTILATOR

Electrically Operated All-Metal Cylinder-Type Washing Machine

The washing machine shown herewith is of the revolving-cylinder type, the cylinder reversing automatically at each revolution, thereby keeping the clothes free from tangle, it is declared, and producing continuous agitation. The machine is of all-metal construction and measures 22 in. by 28 in. by 36 in. in size. It has a capacity of from ten to twelve sheets. After each washing the cylinder can be easily removed

ALL-METAL CYLINDER-TYPE WASHER

for cleaning, insuring sanitary conditions at all times. The wringer is of the reversible type and is equipped with ball bearings, 14-in. rubber rolls, and a special guard. With the guard or clothes hopper the possibility of injuring one's fingers in the wringer is practically eliminated. This guard can be quickly attached to the wringer for operation from either side. The machine is operated by a 1/6-hp. motor for either direct current or alternating current, which is mounted on an adjustable motor board. The washing machine is being placed on the market by the Wash-Easy Company, Fourteenth Street and Western Avenue, Chicago, Ill.

Results of Test of Poppet-Valve Engine

The accompanying data were recently secured in an acceptance test made on a 15-in. by 18-in. type "S" 150-hp. poppet-valve non-condensing engine designed for driving a positive displacement blower. The engine was built by the Nordberg Manufacturing Company, Milwaukee, Wis., and is one of five similar engines recently ordered by the Laclede Gas Light Company of St. Louis.

Power was measured by a Prony brake. Special pre-

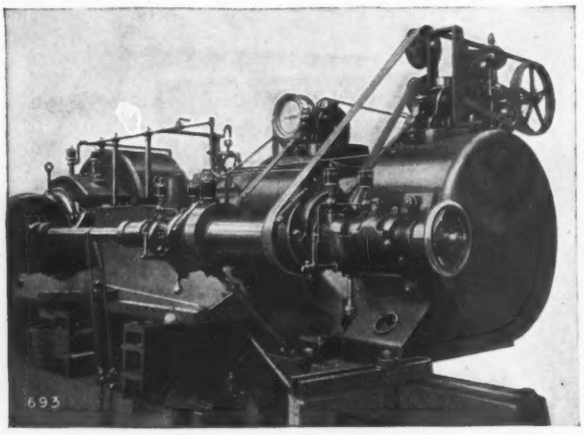


FIG. 1—150-HP. POPPET-VALVE NON-CONDENSING ENGINE

caution was taken in measuring condensate. Ample condenser surface was used to insure a reduction in water temperature from 212 deg. Fahr. down to room temperature so that there was no loss of vapor from the weighing tanks. Pressures and temperatures were taken by standard calibrated instruments and speed

RESULTS OF STEAM-CONSUMPTION TEST

Duration of test	One hour	One hour	One hour
Average speed, r.p.m	199.71	200.30	200.40
Steam pressure, lb. gage	130.00	130.03	130.80
Average back pressure, lb. gage	0.24	0.19	0.19
Quality of steam	0.986	0.99	0.987
Average brake load, brake-hp	185.80	150.00	111.80
Average mean effective pressure, lb. sq. in	62.58	50.83	39.00
Average indicated hp	197.00	160.10	123.00
Mechanical efficiency	0.94	0.937	0.908
Water measured in condenser, lb. hour	4125.50	3211.00	2287.00
Water condensed in cylinder head, lb. hour	79.00	49.00	61.00
Total water condensed, lb. hour	4204.50	3260.00	2348.00
Dry steam admitted to engine, lb. hour	4150.00	3225.00	2320.00
Steam consumption:			
Lb. per brake-hp.-hour	22.32	21.48	20.75
Lb. per indicated hp.-hour	21.05	20.15	18.85

was read by a tachometer and also a totaling revolution recorder. Indicator cards were taken at regular intervals of ten minutes by Ashcroft indicators with calibrated 100-lb. springs. Typical cards are shown in Fig. 2 at 31.7 lb., 60.7 lb., 82 lb. and 92.7 lb. mean effective pressure.

In the accompanying table are shown the results of the test at approximately 200-hp., 150-hp. and 100-hp. loads at a speed of 200 r.p.m. At the best load the steam consumption of 18.85 lb. per indicated horsepower corresponded to an efficiency, referred to the Rankine cycle, of 79.9 per cent, a favorable result with a steam pressure of 130 lb. per square inch and steam containing about 1 per cent moisture. The total water

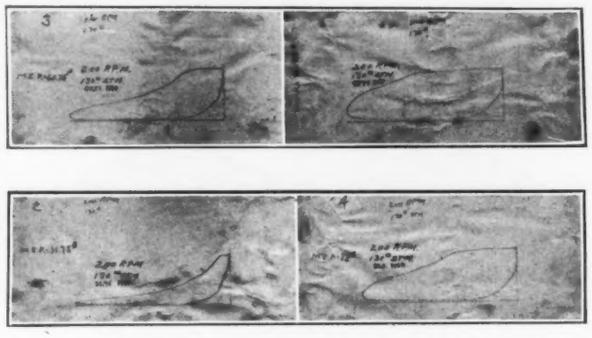
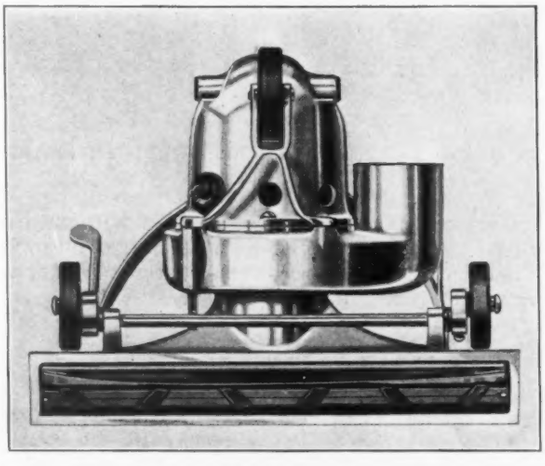


FIG. 2—CARDS TAKEN IN TEST WITH POPPET-VALVE ENGINE

measured was corrected for this moisture and the steam rate is given on the customary basis of dry steam. On the basis of brake-horsepower, the Rankine efficiency is 72.6 per cent, the difference being accounted for by the mechanical efficiency of the engine, 91 per cent.

Light-Weight Electric Vacuum Cleaner

A portable vacuum cleaner developed by the Frank Ridlon Company, Boston, Mass., is provided with an adjusting device which gives five different points of nozzle height. The cleaner is of the pistol-grip-handle type, the switch being in the handle. The suction nozzle is 12 in. wide and is provided with a device for picking up threads. The cleaner is mounted on three wheels and is always in a wheeling position, it is declared, while the hose is attached. The clearance is 5.75 in. above the floor, and the weight complete is 8.75 lb. Use is made of a General Electric motor for operating the machine. The attachments used with the cleaner are as follows:



BOTTOM VIEW OF PORTABLE VACUUM CLEANER

Hose 8 ft. long and 1.25 in. inside diameter, brush for walls, clothes and draperies, upholstery nozzle, combination tool for blowing or suction for renovating pillows, pianos, radiators, cracks and crevices, suction coupling, blower coupling, connector for attachment No. 2, tubular handle for walls and ceilings, and 20 ft. of cord.

An Employee Installing Electric Lamps Comes Under Protection of Employers' Liability Law.—The Supreme Court of Oregon holds (151 P. 472) that an employee engaged in putting up electric lines or installing electric lamps comes within the protection of the employers' liability law, the work necessarily being dangerous.

Electric Signs in Philadelphia.—During 1914 671 permits were issued by the Electrical Bureau of Philadelphia for the installation of electric signs. Four hundred and thirty-one new signs were erected during the year, 214 signs were replaced, and eight temporary signs were erected. Seventy more new electric signs were set in place in 1914 than in 1913.

Siphon Lessens Time for Cleaning Intake Wells.—At the Glenwood station of the Duquesne Light Company of Pittsburgh a large siphon was used in cleaning out the intake wells. This previously was a week's job, but the siphon cut the time required down to two days. The liquids and solids that came out of the well were greenish-black in color with a peculiar odor.

Subway and Elevated Traffic in New York City.—The Interborough Rapid Transit Company of New York in the year ended June 30, 1915, carried 647,378,266 passengers on its elevated and subway lines, a decrease of 4,508,405, or 0.6 per cent, compared with 1914. The subway carried 5,172,646, or 1.52 per cent more than last year, but there was a falling off on the elevated lines of 9,681,051, or 3.11 per cent.

A Beaver Dam 150 Years Old.—A beaver dam recently examined by the New York Conservation Commission shows evidence of being 150 years old—to take the testimony of the trees growing on the structure, which is in the vicinity of Eighth Lake in the Fulton Chain. A section of one tree examined revealed 125 annual rings inside a diameter of 9 in., while other trees 16 in. in diameter rooted on the dam had already rotted away to mere outer shells.

Propose to License Wiring Contractors at Fort Wayne, Ind.—With a view to standardizing the work of electrical contractors at Fort Wayne, Ind., an ordinance has been introduced in the local Council requiring that all contractors pass an examination and pay a license fee of $50 for the first year and $10 for each additional year, besides posting a bond of $500. The contractor must also secure a permit for each contract undertaken. By the proposed ordinance the building inspector is made the inspector of electric wiring work and all jobs must be inspected before being finally closed.

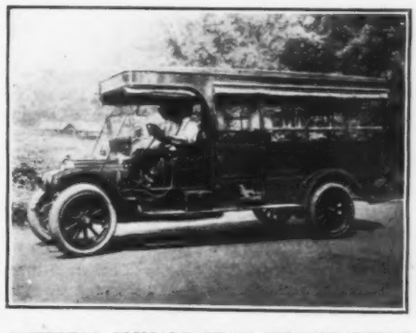
Energy Cannot Be Furnished Outside of Territory Named in Charter.—In the case of the Citizens' Electric Illuminating Company versus the Lackawanna & Wyoming Valley Power Company it was held by the Luzerne County (Pa.) Court (3 P. C. 78) that a company having a charter to do business in a certain territory could not furnish energy to a corporation outside that territory. The leasing of a generating plant does not give the lessor the power which the lessee in the absence of the lease would have had to dispose of surplus energy to territory outside that designated in the lessor's charter.

Multiphase Currents

Miscellaneous News Items Picked from the Happenings of the Industry

Radio Stations in the United States.—The annual edition of the "List of Radio Stations of the United States" compiled by the United States Bureau of Navigation shows the total number of land, ship, special land and amateur stations in the United States to be 5073. This is an increase of 1131 over the 1914 figures. The list shows the number of government and commercial land stations in 1915 to be 224, an increase of thirty-five over 1914. Government and commercial ship stations are the same in number for both 1914 and 1915, namely, 895. Special land stations in 1915 are given as 118 in number, an increase of 64 during the year. The increase in the number of general and restricted amateur stations is given as 1040, the number of stations in 1915 being 3836.

Wireless Station on Baltimore Electrical Commission's Motor Truck.—The Electrical Commission of the city of Baltimore, Md., has in service a motor truck which is equipped with a "wireless" receiving outfit, enabling headquarters to keep in communication with the crew of the truck at all times, so that emergency calls can be handled in the field with the greatest dispatch. The truck serves as a receiving station only, and for its antenna is equipped with 425 ft. of No. 14 rubber-covered copper wire suspended just beneath its roof. During the preliminary tests the truck never failed to intercept messages sent to it within a radius of 10 miles of the sending station. Even under the most unfavorable conditions, with the truck running at full speed and blanketed by tall buildings of steel construction, no difficulty was experienced in reading the messages. A simple code of signals has been adopted to avoid the necessity of engaging trained telegraph operators.



WIRELESS SIGNALS FROM HEADQUARTERS DIRECT THE WORK OF THIS CABLE-MAINTENANCE CREW

Municipal Lighting Bonds Worthless Unless All Terms Are Submitted to Voters.—Under a code authorizing a municipality to issue bonds to meet the cost of certain proposed improvements in the city lighting plant, and providing that if a general indebtedness is to be incurred the amount and terms of the indebtedness shall be included in the proposition submitted to the voters, it was held by the Supreme Court of Washington that a proposition submitted to the voters showing neither the time the bonds were to run nor the interest thereon was insufficient, and that the bonds authorized by the voters did not become an enforcible obligation against the city.

"Under Two Flags"—the Adventure of a French Central Station.—When the Germans first occupied Lille, while the Allies' troops held possession of Armentières near by, the soldier-engineers of the Kaiser's army discovered the abandoned Lille electric-lighting plant and, according to the story told by a British soldier in a letter home, shortly had the generators running and the town once again lighted by electricity. It was some months, however, declares the narrator, before the Germans discovered that the Lille lighting system also connected with Armentières and that a good share of the energy generated inside the Teuton lines was being used to light the Allies' quarters and troop tents in the neighboring city.

Negligence of Fellow-Employee.—The Court of Appeals of Georgia holds (86 S. E. 82) that a servant cannot recover for injuries resulting from the incompetency of a fellow-servant if he had an equal opportunity with the master of discovering such incompetency, or in the exercise of ordinary care should have known of such incompetency. It was further held that an adult servant will be presumed to have knowledge of existing defects or dangers in machinery in connection with which his duties require him to work, and to know of the competency or incompetency of fellow-servants working with him about such machinery, after he has worked with such machinery and with such fellow-servants for a reasonable time.

Anti-Zeppelin Illumination in London.—The stringency with which the London police are enforcing the ordinances for the restriction of shop lighting and house illumination in order to hamper the enemy in making the city a target for the bombs of hostile air craft is illustrated by two incidents reported in a copy of the London *Electrical Review* just received here. In one case a Putney jeweler was fined $100 for failing to extinguish his shop lighting after being cautioned. The police evidence showed he had thirty-six 25-cp. lamps in operation, "throwing a beam across High Street." On the same day a building manager was fined $5 for having allowed the door of the elevator pent-house on the roof of his building to be left open, so that each time the "lift" was started and stopped flashes were visible from the outside.

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Associations and Societies

Los Angeles Jovians.—The luncheon held by the Los Angeles Jovian League on Oct. 13 was addressed by John W. Mitchell on "Some Prophecies on Electrical Development in California."

Meeting of the Electric Power Club.—The next meeting of the Electric Power Club will be held Nov. 8 to 10 at the Homestead Hotel, Hot Springs, Va. C. H. Roth, 1410 West Adams Street, Chicago, Ill., is secretary of the association.

New York Jovians Hear Talk on Advertising.—At the weekly luncheon of the New York Jovian League held at the Hotel Martinique on Oct. 20 J. J. Rockwell, advertising counselor of the McGraw Publishing Company, Inc., talked on "Advertising as a Co-operative Force." Frank E. Watts discussed the recent national convention held in Chicago.

Convention of American Association of Engineers.—The national convention of the American Association of Engineers will be held in Chicago on Dec. 10 and 11. Owing to the increase in its activities the association has taken larger quarters at 29 South LaSalle Street, Chicago. The first of a series of weekly inspection tours by members was made on Oct. 9, when an inspection was made of the tunnels of the Chicago Warehouse & Terminal Company.

Philadelphia Jovians Install New Tribune.—An unusually large attendance was present at the luncheon of the Philadelphia Jovian League which was served at the Hotel Ansonia on Oct. 15, the fourteenth anniversary of the founding of the league in Philadelphia, to witness the installation of Frederick M. Sheppard, senior partner of the firm of Cole & Sheppard, electrical construction engineers, and an ex-president of the Electrical Contractors' Association of Pennsylvania, as tribune by Washington Devereaux, the retiring tribune. Joseph B. McCall, president of the Philadelphia Electric Company, addressed the meeting.

New York Electrical Society.—Greetings to the society over the new transcontinental telephone line by George W. Peck, representative of the telephone company at the Panama-Pacific International Exposition, were one of the features of the opening meeting of the New York Electrical Society held in the Grand Central Palace on Oct. 14. Dr. Frank B. Jewett of the Western Electric Company talked on the significance of the recent radiotelephony demonstration between Arlington and Honolulu. After the meeting, which was a short one, the members of the society were the guests of the management of the Electrical Exposition and Motor Show.

Lynn Section, A. I. E. E.—One of the largest attendances in the history of the Lynn (Mass.) Section of the American Institute of Electrical Engineers was that at the opening meeting of the 1915-1916 season on Oct. 7 to hear H. A. Hornor, chief electrical engineer of the New York Shipbuilding Company, who spoke on "Battleships, Their Fabrication and Electricity's Part Therein." Numerous lantern slides illustrated the various types of motors used for hull ventilation, forced draft, boat-crane control, steering control and a multitude of other uses, and also illustrated the various types of lamps, signaling devices, switchboards, etc., in use on American battleships.

Western New England Electrical Inspectors Meet.—A meeting of the Western New England Section of the National Association of Electrical Inspectors was held at the Weldon Hotel, Greenfield, Mass., Oct. 13. Vice-president A. H. Hopkins of Springfield occupied the chair. A paper on "Outdoor-Station Development and Equipment" was presented by F. L. Hunt, chief engineer of the Turners Falls Power & Electric Company, Greenfield. The National Electrical Code was also discussed, and in the afternoon the delegates were taken in automobiles to the Montague City hydroelectric development of the Turners Falls Company. Prominent insurance men, municipal-plant managers and central-station men were present as guests.

Yale Engineering Association Formed.—There has been recently formed an organization among graduates of Yale University known as the "Yale Engineering Association," the purposes and objects of which are set forth in a circular letter which has been widely distributed to Yale graduates. Similar associations are being successfully conducted by engineering graduates of Harvard, Princeton and Cornell, and the co-operation of all Yale graduates is sought to the same end. Membership is open to any person holding a degree from Yale University, and the eligibility of former Yale students who have not yet received a degree will be passed upon by the executive committee. The main objects of the association are to help the educational work at Yale, to establish cordial and mutually helpful relations between Yale engineers, and to help Yale engineers generally. The executive committee of the association consists of Edwin M. Herr, '84, president Westinghouse Electric & Manufacturing Company, president; Harry N. Covell, '83, works manager Lidgerwood Manufacturing Company, vice-president; Richard T. Dana, '96, consulting engineer, secretary-treasurer; Donn Barber, '93, architect, New York City; F. L. Bigelow, '81, president the Bigelow Company, New Haven; Charles A. H. De Saulles, '99, vice-president United States Zinc Company; W. E. Dowd, Jr., '00, consulting engineer; Vance C. McCormick, '93, member Yale Corporation; W. W. Nichols, '84, assistant chairman Allis-Chalmers Manufacturing Company; J. C. Tracy, '90, assistant professor structural engineering, Sheffield Scientific School, and E. G. Williams, '87, vice-president J. G. White Corporation. While any Yale graduate is eligible for membership, yet the association appeals more strongly to those who are engaged in engineering pursuits, transportation or manufacturing. It is proposed to hold the first meeting of the association in New Haven in the early part of November. A committee from the executive board is actively engaged in arranging an attractive program and a large attendance is expected. The present membership of nearly 500 is rapidly growing.

Joint Meeting of Electrical Men in Portland, Ore.—The joint meeting of the Portland Section of the National Electric Light Association and the Portland Section of the American Institute of Electrical Engineers was held at the Automobile Club, near Portland, on the evening of Oct. 13. This meeting, which was the opening one of the usual winter series, drew the largest gathering of electrical men ever held in Portland and also the most enthusiastic. There were 143 electrical men present, representing every branch of activity in Portland. The meeting was presided over by E. A. West, efficiency engineer of the Portland Railway, Light & Power Company. Mr. West first introduced J. E. Davidson, vice-president and general manager of the Pacific Power & Light Company, and a member of the executive committee of the national association. Mr. Davidson told in a general way what the Portland sections would endeavor to do during the coming year, particularly in the way of giving a good, high-class series of talks and other entertaining features. Mr. Davidson has been striving to form a better consolidation of the electrical men of Portland, and the prospects for such an improved organization now seem good. P. L. Lebenbaum of the Southern Pacific Company, chairman of the Portland Section of the A. I. E. E., also mentioned the plans for the association during the coming winter. Following Mr. Lebenbaum, O. B. Coldwell, general superintendent of the Portland Railway, Light & Power Company, outlined the work of the attendance committee and promised that the meetings would be well attended.

Lewis A. McArthur of the Pacific Power & Light Company, chairman of the program committee, gave in detail the proposed program for the year, including addresses on banking, credits, commercial law, industrial chemistry, wireless telephony, electrical cooking, operating the slide rule, electricity in schools, overhead-line construction, utilization of waste, rural uses of electricity, electric-railway operation, block signals, electric vehicles, etc. These papers will all be prepared by men who are familiar with the subjects. Rufus Holman, County Commissioner of Multnomah County, spoke briefly on what the commission has been able to accomplish through efficient management and better organization. Meetings will be held once a month until June, 1916. The next meeting is scheduled for Nov. 9.

Public Service Commission News

New York Commissions

The Public Service Commission, First District, New York, handed down an order last week against the New York Edison Company and the United Electric Light & Power Company providing that after Jan. 1, 1916, both companies when making free renewals of lamps to their customers shall supply tungsten lamps of 50 watts rating and above. Smaller sizes of tungsten lamps are to be provided to customers at a price not exceeding the actual renewal cost of such lamps. On May 1, by order of the commission, both companies reduced their price for energy from 10 cents to 8 cents per kilowatt-hour and allowed the renewal of tungsten lamps when the customer paid an additional half cent per kilowatt-hour for energy. The present order cuts out this half cent per kilowatt-hour and also provides that the companies shall not refuse to supply energy to any applicant on the ground that the applicant is either the owner or operator of a private plant or a customer thereof, provided that he is not selling energy to others outside of his own premises. After Jan. 1, 1916, the companies shall determine the amount of energy supplied by means of a master meter or meters installed on the premises of the customer. The schedules or service regulations of the companies shall prescribe the conditions under which a customer of the companies may make application for exchange service to or from either of the said companies. This action was taken in conformity with an opinion of Commissioner G. V. S. Williams. Commissioner William Hayward also submitted an opinion in the case, holding that the companies should be compelled to supply to consumers tungsten lamps of 25 watts without charge.

California Commission

The Railroad Commission of California has recently published a report outlining the public utility development work carried on in that State since the commission assumed jurisdiction over stocks and bonds, a period of approximately three and one-half years from March, 1912, to September, 1915. During this period stocks, bonds, notes and certificates have been authorized by the commission amounting to $466,000,000, the report states. Of this amount $175,000,000 has been authorized for the payment of maturing debts; $248,000,000 has been authorized for new construction, additional development of existing utilities and new ventures, and the balance has been used for miscellaneous purposes. The authority for new improvements has been distributed in the report as follows: Steam railroads (including $25,000,000 for expenditures outside of California), $102,800,000; electric railroads, $32,500,000; gas and electric companies, $80,000,000; water companies, $18,500,000; telephone and telegraph companies, $2,500,000; warehouses, $1,600,000; pipe lines, $10,000,000. Approximately $200,000,000 of the foregoing has already been expended or is in the process of expenditure. During the three-and-one-half-year period under review there have been launched sixteen new railroad enterprises, thirteen new gas and electric companies, six new telephone companies, a new five-million-dollar oil-pipe line, an independent ferry line on San Francisco Bay, and many new water companies. Seven hundred miles of new railway lines have been constructed or are now being constructed under authority of the commission, and water-power projects involving the development of a total of 100,000 hp. have been initiated.

Corporate and Financial

Dayton (Ohio) Power & Light Company.—The New York Stock Exchange will admit to list $2,306,500 of 6 per cent cumulative preferred stock and $3,053,000 of common stock on official notice of issuance of permanent engraved interchangeable certificates, with authority to add $656,000 additional of preferred stock on official notice of issuance of permanent engraved interchangeable certificates and payment in full.

East St. Louis (Ill.) Light & Power Company.—A block of first mortgage 5 per cent gold bonds, due June 1, 1940, is being offered to investors at 96½ and interest. The total amount outstanding is $973,000.

Edison Electric Illuminating Company of Boston, Mass.—The total connected load in 50-watt equivalents, according to the company's annual report, just issued, at the end of June for each of the last five years, is shown in the following table:

1911	2,773,838	1914	3,973,881
1912	3,075,783	1915	4,382,856
1913	3,502,925		

While the increase in the total connected load is materially less than for 1914 and slightly less than for 1913, it is very much larger than for any previous year, and this the company considers highly satisfactory in view of the marked arrest of business expansion caused by the European war, especially in its early days. A comparative statement of operations for the years ended June 30, 1914 and 1915 follows:

	1915		1914	
Gross earnings		$7,429,124		$7,008,288
Expenses		3,426,832		3,153,271
Net income from operations		$4,002,292		$3,855,017
Miscellaneous profits		118,910		57,134
Total		$4,121,202		$3,912,151
Taxes		843,450		785,713
Net earnings		$3,277,752		$3,126,438
Interest	$371,475		$399,615	
Dividends	2,457,174	2,828,649	2,252,319	2,651,934
Undivided profits		$499,103		$474,504

President Charles L. Edgar, commenting on the year's activities, said in part: "Owing to the breaking out of the European war and the uncertainty as to what might result from its continuance, the directors decided that, while the company should continue to make every effort to get new customers upon its existing lines, it should at the same time make every effort to restrict expenditures and to postpone, as far as possible, such construction work as had to do with covering new territory. This policy has been carried out ever since the beginning of the war, and the management wishes to put on record its appreciation of the cordial assistance which has been given to it during the year by all of its employees in its efforts to this end. The result of this attempt is shown very clearly in three directions: First, in the increase in the connected load referred to above, which is nearly equal to that of a normal year. Second, in a comparison between the balance sheets for the years 1914 and 1915. At the end of the fiscal year 1914 there was in the unfinished-installations account over $2,400,000, representing separate appropriations to the number of 400. At the end of the fiscal year 1915 this account was only $843,000, and the number of appropriations was only 198. Third, the result appears in the pay-roll of your company, which during the years 1913 and 1914 showed an average increase of about $5,500 per week over the corresponding week of the previous year, but which, since the first of January, 1915, shows an average increase of less than $1,500 per week and at one time was actually less than for the corresponding period of the previous year. This has not been brought about by any reduction in wages or by the wholesale discharge of employees, but by keeping down in every way the necessity for the adding of new employees. In view of the unusual business situation which existed during the past year, the condition of the company is extremely satisfactory, and even if its business should continue to grow in an increasing ratio during the coming year, there seems to be no need of considering a further increase of the company's capital stock during the year."

Narragansett Electric Lighting Company, Providence, R. I.—The 10,000 new shares of capital stock which will be dated Nov. 1, 1915, will be credited with two-thirds of the dividend rates to be paid on the old stock for the current quarter. This quarter began Oct. 1 and will end Dec. 31, and as the subscribers to the new stock are not to pay for it until Nov. 1, the corporation is averse to the declaration of any unearned dividend. The full rate for a quarter is $1 per share.

Philadelphia Company, Pittsburgh, Pa. — Announcement has been made that Charles Hayden of Hayden, Stone & Company has been elected a member of the board of directors of the Philadelphia Company and of the Duquesne Light Company to fill the places left vacant by the resignation of W. B. Carson.

St. Cloud (Minn.) Public Service Company.—An issue of $700,000 of 6 per cent first mortgage gold bonds, due Nov. 1, 1934, is being offered at par and interest. For the year ended July 31, 1915, the earnings of the company were as follows:

Gross earnings	$235,275
Operating expenses, rentals, maintenance, taxes, etc.	138,427
Net earnings	$96,848
Interest	42,000
Surplus	$54,848

Toronto (Canada) Hydroelectric System.—The annual report for 1914 shows a total number of consumers connected to the system at the end of the year of more than 31,500, their connected load being more than 88,000 hp. A comparative statement showing the growth in gross income during the year from different parts of the system's business is contained in the following table:

Gross Income	1913	1914
Commercial lighting	$411,905.17	$576,684.66
Commercial power	229,615.08	330,466.35
Exhibition light and power	22,525.87	20,334.93
Municipal buildings lighting	12,270.76	18,495.10
Municipal power	117,093.80	157,700.60
Municipal street lighting	344,933.79	364,214.17
Other municipalities	419.00	1,610.52
Sundry other sources	20,576.24	31,785.14
Total	$1,159,339.71	$1,501,291.47

Up to the last of August sixty-five of the system's employees had enlisted for active military service in the war. Besides authorizing an expenditure of $5,000 for patriotic purposes, the system has paid in the case of the regular men who have enlisted the difference between the government pay and the rate of wages previously received from the system. H. H. Couzens, general manager of the system, commenting upon the year's operations, says in part: "The year 1914 was, generally speaking, one of consolidating the position of the enterprise and reviewing what had gone before, making such adjustments as were necessary and practicable. This involved considerable expenditure apart from the special items taken care of out of the surplus of the year and had a material bearing on the cost of working for the year. In spite of the conditions arising out of the war and the previous depression, the net increase in consumers connected to the system during the year amounted to more than 9000. This represented an increase of over 40 per cent for the year. The increased sale of energy has not been in proportion to the new connections, however, largely owing to the fact that many old consumers' requirements were reduced very greatly by the war. There has, however, been a very satisfactory over-all increase in spite of this." The results of the operations for the year ended Dec. 31, 1914, follow:

Gross income	$1,501,291
Cost of energy and expenses of operation and management, including repairs and maintenance	874,358
Balance on operating account	$626,933
Charges and allowances not strictly attributable to the operating expenses for the year 1914, and other charges and allowances applicable to prior years	69,536
Balance of net income	$557,397
Interest, depreciation and sinking funds	556,514
Balance of net surplus	$883

United Light & Railway Company, Grand Rapids, Mich.—A block of first and refunding mortgage 5 per cent gold bonds is being offered at 85 and interest to yield about 6.5 per cent.

Manufacturing and Industrial

The Quigley Furnace & Foundry Company has moved its main office from Springfield, Mass., to the Tilden Building, 105 West Fortieth Street, New York.

The Wagner Electric Manufacturing Company, St. Louis, Mo., has established a branch office at 751 Ohio Building, Toledo, Ohio, which will be under the management of A. B. Emrick.

The Electric Service Supplies Company, Seventeenth Street and Cambria Street, Philadelphia, Pa., has recently appointed the Grayson Railway Supply Company of St. Louis as its sales representative in the Southwestern territory, comprising Missouri, Arkansas, Texas and Oklahoma.

Fifty-fifth Anniversary of Milwaukee Electric Supply Concern.—The Julius Andrae & Sons Company, Milwaukee, Wis., dealer and jobber in electrical supplies and automobile accessories, recently celebrated the fifty-fifth anniversary of the founding of the concern by Julius Andrae, the president of the company.

The College City Electric Company, Galesburg, Ill., has recently been formed by L. H. Harlow, who has been wire chief for the Central Union Telephone Company of Galesburg and who has spent some twelve years in the telephone field. The concern will deal in communicating telephone systems and farm-lighting plants.

Contract for German Goods in China.—It is reported that contracts for turbines and other equipment have been made by German firms for shipment to China, delivery being guaranteed before the close of the year. The prices for the apparatus are said to be considerably lower than those quoted by companies of other countries.

The Anderson Electric Car Company, Detroit, Mich., has appointed E. P. Chalfant in charge of its Eastern territory with headquarters at Sixty-sixth Street and Central Park West, New York City. Mr. Chalfant was formerly manager of the Association of Licensed Automobile Manufacturers and later became president of the E. R. Thomas Motor Car Company. In 1914 he became secretary of the Electric Automobile Manufacturers' Association with headquarters at Chicago.

The Union Switch & Signal Company, Swissdale, Pa., has appointed George A. Blackmore general sales manager in charge of its New York, Montreal and Atlanta offices with headquarters in New York. The resident managers, A. Dean of New York and T. H. Patenall of Montreal, and Mr. Brastow, sales engineer at Atlanta, will report to Mr. Blackmore. Eventually Mr. Blackmore's headquarters will be changed to Swissdale and he will be placed in charge of sales, construction and commercial engineering.

Business in Expansion Bolts Improving.—As an indication that there is a resumption in building and construction activities, the Diamond Expansion Bolt Company, 90 West Street, New York, is receiving numerous orders for its products, which are chiefly in demand by contractors. The company was the recipient of a gold-medal award for its products exhibited at the Panama-Pacific Exposition. Copies of the official award ribbon have been printed and are being pasted to the company's letters and printed matter.

United States Light & Heat Corporation Sales Convention.—More than fifty branch managers and salesmen of the United States Light & Heat Corporation, Niagara Falls, N. Y., attended the recent sales convention of the company, which ended Oct. 15. Daily business sessions were held at which the new sales and advertising policies of the company were taken up in detail and explained to the salesmen. Talks on various subjects were made by J. Allan Smith, president; Harry Ackerman, vice-president and general manager, and C. C. Bradford, sales manager.

Imports of Incandescent Lamps from Austria-Hungary.—According to Consul-General Albert Balstead, stationed at Vienna, the incandescent-lamp industry of Austria-Hungary has devoted considerable attention to the cultivation of a market in this country for incandescent-lamp bulbs and for complete lamps. Shipment of the bulbs has been rather steady, he states, and has had a normal growth, but the sale of the completed lamps has developed very rapidly.

The declared value of bulbs and lamps sent to the United States in 1914 was $244,473, an increase of $22,564 over 1913 and of $193,316 over 1912. This increase over 1913 would undoubtedly have been greater had it not been for the disturbance of trade in the last five months of the year.

Trial Order of Series-Multiple Transformers Purchased at Milwaukee, Wis.—The Kuhlman Electric Company of Bay City, Mich., has just closed an order for a trial installation of series-multiple transformers which are to be used in connection with the new street-lighting system at Milwaukee, as outlined in the report of Vaughn, Meyer & Sweet. The total installation at Milwaukee will when completed comprise about 8500 lamps. The trial installation now being made will light about one mile of the city's streets.

Vacuum Cleaner with Curry-Comb Attachment for Cleaning Military Uniforms.—A. B. Kirshbaum & Company of Philadelphia have been using two stationary vacuum cleaners extensively for cleaning military uniforms which they manufacture. The collars and cuffs of many of the coats are of goatskin, and little pieces of the fur tend to collect on the uniforms. This material is rather difficult to remove and for the purpose a special curry-comb attachment has been provided. It is said that two men operating these machines can clean 700 coats a day. Finally, after a day's work another attachment is utilized to clean up the establishment. The machines were made by the Santo Manufacturing Company of Philadelphia. Stationary-type machines are also becoming very popular, the company claims, with contractors and others who are building houses for investment purposes. By installing a stationary cleaning system the value of the house is increased, and often a price can be obtained because of the improvement which will more than pay for the additional expense involved.

New Electrical Equipment for Paper Mills.—The Crown Willamette Paper Company of Portland, Ore., will shortly increase the rating of its electric generating station at Oregon City by installing a 1250-kw. waterwheel-type alternating-current generator. The machine will operate in parallel with two smaller machines already installed. The present switchboard equipment will be replaced with a six-panel board designed to handle both the old and the new generators, together with transformer and feeder equipment. The new equipment will be supplied by the Westinghous Electric & Manufacturing Company, East Pittsburgh, Pa. Other orders received by the Westinghouse company are as follows: The American Writing Paper Company, a 550-hp. motor for its Platner and Portland Division plant at Unionville, Conn., and the Berlin (N. H.) Mills Company, twenty alternating-current motors aggregating 365 hp. The Unity Paper Mills, Inc., has recently taken over the property of the Potsdam (N. Y.) Paper Company and will install a number of Westinghouse motors in the mill.

British South Africa's Imports of Electrical Mining Machinery and Supplies.—Although the depression arising from the war had but little effect on the output of the principal gold mines in British South Africa, there was a marked curtailment of new developments and therefore a decided decrease in the purchases of mining machinery and supplies. To what extent the imports of electrical materials for mining operations were affected is shown in the accompanying table for 1913 and 1914. The imports decreased by more than $600,000. Gains, however, were made by the United Kingdom and the United States, the former's amounting to over $200,000 and the latter's to $70,000. The great decrease was borne by Germany, the loss in import of German goods being approximately $1,000,000 in values.

IMPORTS OF ELECTRICAL MINING SUPPLIES TO BRITISH SOUTH AFRICA DURING 1913 AND 1914

Materials	United Kingdom		Germany		United States		All Others		Totals	
	1914	1913	1914	1913	1914	1913	1914	1913	1914	1913
Cable and wire	$1,604,674	$1,581,943	$279,935	$671,207	$120,076	$168,162	$69,605	$82,195	$2,074,290	$2,503,507
Fittings, including posts	765,203	753,212	192,265	324,279	107,321	143,941	64,573	62,202	1,129,362	1,283,634
Machinery	857,044	690,969	818,593	1,229,988	401,953	248,468	31,858	26,726	2,110,448	2,196,151
Totals	$3,226,921	$3,026,124	$1,290,793	$2,225,474	$629,350	$560,571	$166,036	$171,123	$5,314,100	$5,983,292

Large Central-Station Battery.—The Detroit Edison Company of Detroit, Mich., has contracted for the building and erection of a central-station storage battery, which, it is said, will be the largest battery ever built for emergency use. The battery will consist of 150 cells, each containing 169 plates of the "H Exide" type. Each of the 150 lead-lined tanks will measure 6 ft. 7⅝ in. in length, 21.75 in. in width and 4 ft. 2 in. in height. Each cell complete with plates and electrolyte will weigh 7700 lb. The rating of the complete battery will be 12,600 amp. for one hour, or 26,040 amp. at the twenty-minute emergency rating. In connection with the operation of this large battery the Electric Storage Battery Company, Philadelphia, Pa., the maker, will also build four seven-point, 10,000-amp. motor-driven end-cell switches, two of which are to be placed on each side of the three-wire system. The apparatus will be installed in the Congress Street substation of the Detroit Edison Company and will, it is expected, be completed for service about Dec. 15 of this year.

Electric Vibrators Popular with Chinese and Japanese.—The Hamilton-Beach Manufacturing Company, Racine, Wis., has recently been shipping electrically operated vibrators to China and Japan in considerable numbers. It has also been receiving orders for its hair driers, vibrators, drink mixers and sewing-machine motors from South American countries, France, England and Denmark. Among the orders just received is one for 200 electric hair driers from Paris. The company is noting an ever-increasing demand for the new sewing-machine motor, which was described in the ELECTRICAL WORLD of Sept. 25, 1915. Business has been very good for the Hamilton-Beach company and has increased 25 per cent thus far this year over the same period of last year. A book entitled "Health and How to Get It" has been edited by C. L. Bryson under the direction of the Hamilton-Beach company, and a copy is given to each purchaser of one of the company's vibrators. The book is cloth-bound and contains 300 pages. It is well illustrated and describes various methods of treating diseases by means of electric vibrators.

Awards in Western Electric Company Fan-Window Contest.—The New Orleans Railway & Light Company, New Orleans, La., won first prize and a cash award of $50 in the window-display contest conducted by the Western Electric Company's advertising department to determine the best electric-fan window exhibits made by dealers and central-station companies throughout the country in connection with the company's window-display campaign of the past summer. The pictures of displays entered by the contestants were adjudged by a committee made up of a representative of the Society for Electrical Development, Inc., and representatives of the electrical press. Second prize, $25, went to the Home Electric Company, Ecanaba, Mich.; third prize, $10, to the Albuquerque (N. M.) Electric Light & Power Company, and the remaining three prizes, each $5, to the Clinton (Ind.) Electric Light & Power Company, the Paducah (Ky.) Electric Light & Power Company, and the Consumers' Electric Light & Power Company, New Orleans, La. The Western Electric Company furnished the contestants with the cut-out backgrounds and ocean-beach settings for the displays, all carrying out the underlying idea of the campaign—"A cool wave is here"—but the fans and other features were furnished by the exhibitors.

General Electric Strike.—According to an announcement made by the General Electric Company at Schenectady to its 13,000 striking employees, all workmen not in the shops at 7 a. m. Oct. 20 would be considered as discharged. The strike leaders, however, intimate that the strike will continue until the demands are granted and will also spread to the Lynn, Pittsfield and Fort Wayne works of the company. Already a sympathy strike has been inaugurated at the plant of the General Vehicle Company, Long Island City, which is closely allied with the General Electric Company. The men left their work Oct. 20 without presenting any demands.

Westinghouse Electric Takes Over Sale of Westinghouse Machine Company's Products.—Formal announcement has been made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., that, effective Aug. 1, the sale of the standard products of the Westinghouse Machine Company was taken over by the prime-mover department of the Electric company. E. H. Sniffin, formerly vice-president and sales manager of the Westinghouse Machine Company, has been appointed manager of the prime-mover department and will direct the sales of the product of the Westinghouse Machine Company as heretofore. Mr. Sniffin became associated with Westinghouse, Church, Kerr & Company in 1888, first as salesman and afterward as sales manager. In 1903, when the Westinghouse Machine Company organized a sales department, Mr. Sniffin was appointed sales manager. Subsequently, in 1905, he was elected vice-president. A marine department of the Westinghouse Machine Company has also been established, with headquarters at East Pittsburgh, Pa., which will handle all matters pertaining to the sale of marine refrigeration and main propulsive machinery. The Atlantic seaboard and Great Lakes negotiations will be handled by H. H. Southgate, district manager, with headquarters in the Bibbs Building, Washington, D. C. The Pacific Coast marine business of the company will be handled by Hunt, Mirk & Company, 141 Second Street, San Francisco, Cal.

NEW YORK METAL MARKET PRICES

	Oct. 11 Selling Prices Bid	Asked	Oct. 19 Selling Prices Bid	Asked
	£ s d		£ s d	
London, standard spot*	.. .. ..		72 17 6	
Prime Lake	17.87½	to 18.12½	17.75	to 18.00
Electrolytic	17.87½	to 18.12½	17.62½	to 17.87½
Casting	17.25	to 17.50	17.12½	to 17.37½
Copper wire base	19.25	to 19.50†	19.00	to 19.25†
Lead	4.50		4.50	
Sheet zinc, f.o.b. smelter	16.00†		16.00†	
Tin, Straits	32.75†		33.30†	
Aluminum, 98 to 99 per cent	55.00	to 57.00	54.00	to 55.00†

†OLD METALS

Heavy copper and wire	15.25†	15.25†
Brass, heavy	10.25†	10.25†
Brass, light	8.50†	8.50†
Lead, heavy	4.00†	4.00†
Zinc, scrap	10.00†	10.00†

*COPPER EXPORTS

Total tons to Oct. 19	12,187

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Industrial Companies

The Keokuk Electric-Metal Company, Keokuk, Iowa, has been incorporated with a capital stock of $100,000 by W. D. Baldwin, New York, N. Y.; C. G. Comstock, Cleveland, Ohio, and others.

The Guaranteed Appliance Company, Chicago, Ill., has been incorporated by Prescott D. Bennett, Reuben N. Trane and Dudley Taylor. The company is capitalized at $5,000 and intends to manufacture and deal in electrical appliances.

The Trotter Manufacturing Company, Rochester, N. Y., has been chartered with a capital stock of $30,000 for the purpose of manufacturing machines, fixtures, appliances for heat, light and refrigeration. The incorporators are C. Elwell, Frank C. and Henry L. Trotter, Rochester.

New Incorporations

The Dempster Light & Power Company, Dempster, S. D., has been incorporated with a capital stock of $2,500 by John G. DeWahl and others.

The Glen Hope Light, Heat & Power Company, Glen Hope, Pa., has been incorporated with a capital stock of $5,000 by Warren Partridge, W. O. Hoover and J. P. O'Laughlin. The offices of the company will be in Clearfield.

The Western Sumner County Light & Power Company of Wellington, Kan., has been incorporated by N. L. Jones and G. G. William of Wellington, W. E. Stewart of Mayfield, F. M. Sumpton of Argonia, and E. T. Stewart of Milan. The company is capitalized at $10,000 and purposes to build a power plant near Mayfield and supply electricity for lamps and motors in Mayfield, Milan, Argonia and possibly Wellington.

Trade Publications

Switching Boxes.—The G. & W. Electric Specialty Company, 7440 South Chicago Avenue, Chicago, Ill., has prepared an illustrated folder on its switching boxes.

Brush-Type Switch.—The Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y., is sending out an illustrated catalog on its brush-type safety switch and cabinet.

Chain-Screen Doors for Furnaces and Ovens.—The E. J. Codd Company, 700 South Caroline Street, Baltimore, Md., has prepared two illustrated bulletins on its chain-screen door for furnaces and ovens.

Molded Insulating Material. — Catalog No. 7 issued by the Dickinson Manufacturing Company, Springfield, Mass., contains information on various molded electrical insulating devices and other composition goods.

Stamp Mills for Mining Service.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has recently brought out Bulletin No. 1432-A on its stamp mills and accessory machinery for free-milling gold ores.

Connectors.—The Economy Service Connector Company, 609 West Fifth Street, Coffeyville, Kan., has prepared a folder which contains information on a device for connecting and disconnecting electric service wires to consumers from the main wires.

Power-Transmission Chains.—The Morse Engineering Company, St. Louis, representative of the Morse Chain Company, Ithaca, N. Y., has prepared Bulletin No. 514, which contains information on a Morse silent chain for a 600-hp. equipment.

Wire and Cables.—Catalog No. 6, recently published by the Belden Manufacturing Company, Chicago, Ill., contains 181 pages on electrical wires, cables and cordage. The catalog is very complete and contains numerous illustrations and tables.

Industrial Lighting.—The Cooper Hewitt Electric Company, Hoboken, N. J., has prepared a well-illustrated catalog entitled "Economics of Industrial Lighting." The catalog contains information on and numerous illustrations of actual installations of the Cooper Hewitt mercury-vapor lamps.

Cylinder-Type Electric Washer.—The Wash-Easy Company, Fourteenth Street and Western Avenue, Chicago, Ill., has issued several illustrated folders on its all-metal, cylinder-type electrically operated washing machine. The company has also published a leaflet on its new safety wringer guard.

Motors and Generators.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has prepared Leaflet No. 2390 on its type E engine-driven alternating-current generators with ratings of from 62.5 kva. to 1750 kva., Leaflet No. 2389 on its type G belt-driven alternating-current generators with ratings of from 25 kva. to 312 kva., Descriptive Leaflet No. 3811 on installations of motors for main rolls of steel mills, and Descriptive Leaflet No. 3787 on type CS squirrel-cage induction motors with ratings of from 150 hp. to 650 hp.

Construction News

New England

GEORGES MILL, N. H.—The plant being erected at George Mills by A. F. Stockton is intended to form a part of extension via Georges Mills to New London, Sutton and other towns by the Sunapee El. Lt. & Pwr. Co., Sunapee, now owned and operated by the Central Pwr. Co., which also owns the Newport El. Lt. & Pwr. Co., Newport. The plant in Georges Mills will be run temporarily by a Pelton motor operated by water from the town water main, which will probably be discarded later for high-tension service from the central station at Newport.

LUDLOW, VT.—The electric-light commissioners have been authorized to contract with the Colonial Pwr. & Lt. Co., Manchester, for energy to operate the municipal electric-light plant. The village has also authorized the Village Trustees to borrow $3,000 to pay for the expense of connecting the municipal system with the lines of the Colonial company.

HULL, MASS.—The Town Council, it is reported, is considering a proposal for the sale of the municipal electric-light plant.

WINTHROP, MASS.—The electric-light committee has entered into a new contract with the Suburban Gas & El. Co., Revere, under the terms of which the present 60-cp. incandescent electric lamps will be replaced with nitrogen-filled lamps.

PROVIDENCE, R. I.—The Narragansett El. Ltg. Co., Providence, is erecting a new high-tension transmission line from its substation in East Providence to the mills in Phillipsdale.

PROVIDENCE, R. I.—A permit has been granted to the Narragansett El. Ltg. Co., Providence, for the erection of a new substation, 105 ft. by 48 ft., on Admiral Street, near Chad Brown Street.

REDDING, CONN.—The electric plant, owned by D. S. Sanford, supplying electricity for lighting the Sanford School at Redding Ridge, was recently destroyed by fire.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by Isidore Wachsman, secretary board of contract and supply, Albany, until Nov. 1, for construction of fire-alarm station to be erected on site bounded by Delaware and Myrtle Avenues and Lark and Morris Streets. Separate bids to be submitted on plumbing and gas work, heating and electric wiring. The Obenau-Nichols Co., 119 State Street, is architect.

ALBANY, N. Y.—Bids will be received by the trustees of public buildings, Executive Chamber, Capitol, Albany, until Oct. 25 for alterations in executive offices, Capitol, including electric work, construction work, heating and plumbing work. Drawings and specifications and blank forms of proposals may be obtained at the Department of Architecture, Capitol, Albany. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York, N. Y. Lewis F. Pilcher is state architect.

BROOKLYN, N. Y.—Bids will be received at the office of the Mayor, borough of Manhattan, New York, until Nov. 1 for the following work for the Fourteenth Infantry Armory, borough of Brooklyn: (1) Mason work, excavation work, etc.; (2) electric work; (3) heating work; (4) plumbing work. Separate proposals to be submitted for each item. Blank forms and further information may be obtained at the office of the Armory Board, Room 6, Basement, Hall of Records, borough of Manhattan.

BUFFALO, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 2 for the removal of the old and installation of a new vault door, including the installation of lining plates, metal vault equipment and electric conduits and wiring, opening into the cashier's room in the United States post office at Buffalo, N. Y., in accordance with drawings Nos. V-400 and V-401 and specifications, copies of which may be obtained at the above office or from the custodian of building at Buffalo.

COBLESKILL, N. Y.—The Mohawk Hydro-Electric Co., Ephratah, is planning to extend its transmission line to supply electricity to the Courter El. Co., which furnishes electrical service in Cobleskill. The work will include the erection of a substation in Cobleskill and about 900 poles and 65 miles of wire. The contract has been awarded to the Mohawk Improvement Co. William C. Dunlop is engineer in charge.

WARREN, N. Y.—Plans are being considered by the Elks' Club for the installation of an ornamental lighting system on Pennsylvania Avenue.

WATERTOWN, N. Y.—The installation of an electric generating plant at the poor farm asylum and building is under consideration by the commissioners.

COLUMBIA, PA.—The Borough Council has decided to use ornamental lamp standards for street lighting, of which 58 will be erected on the principal business thoroughfares.

NEW OXFORD, PA.—The Town Council is considering a proposal submitted by D. L. Martin, representing a company in Honey Brook, for lighting the town with electricity. The company proposes also to furnish electrical service in East Berlin and other nearby towns.

PHILADELPHIA, PA.—Three school buildings, to cost $500,000, $250,000 and $200,000 respectively, will be erected by the Board of Education of Philadelphia. Bids, it is understood, will soon be asked for. J. Horace Cook is architect.

PHILADELPHIA, PA.—A hospital building and power plant, to cost $250,000, will be erected at Fifty-third Street and Cedar Avenue for the Misericordia Hospital. E. F. Durang & Son, 1200 Chestnut Street, Philadelphia, are the architects.

PHOENIXVILLE, PA.—The Borough Council has adopted a resolution introduced by E. A. Barkely asking that the Council go on record as favoring a municipal lighting system and that bonds to the amount of $45,000 be issued to construct the plant. The proposition will have to be submitted to the voters.

SPRING, PA (not a post office).—Application has been made by T. K. Leidy, attorney, representing the Krick El. Co., to the Public Service Commission for permission to supply electricity for lamps and motors in Spring Township.

WEST HAZLETON, PA.—The Borough Council is considering a proposal submitted by the Harwood El. Co. for the installation of a new street-lighting system.

ELIZABTH, N. J.—Plans have been filed at the office of the building inspector for the construction of a power house at the General Hospital to cost $6,786.

ORANGE, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 15, for furnishing and installing lighting fixtures in the United States post office at Orange, N. J. For details see proposal columns.

MILTON, DEL.—The Town Council has awarded the contract for construction of a municipal electric-light plant to W. W. Conwell at $8,600.

BALTIMORE, MD.—H. K. McCay, harbor engineer, has been authorized by the Board of Estimates to prepare plans and specifications for the construction of a hydroelectric plant at Jones' Fall to supply electricity for lighting the city. It is understood that the plans provide that specifications should be prepared, advertising for bids to build and operate the plant and furnish electricity to the city at a flat price, not to exceed the present price. After ten years the entire plant is to revert to the city.

BALTIMORE, MD.—Plans for the extension of the ornamental lighting system on Hanover Street from Lombard to Winder Street, the approach to the New Hanover Street bridge, and also for lighting the bridge, have been submitted to the Board of Estimates by Lighting Superintendent Mohr. The cost of lighting the bridge is estimated at $6,000 per year, and the plans provide for 356 lamps erected on ornamental standards, each mounted with two 100-cp. incandescent lamps. The cost of the Hanover Street extension would be $11,765, and maintenance $6,500 per year at present rates. The estimate also provides for lighting the dark alleys throughout the city.

BLACKSTONE, VA.—The local electric-light plant and water-works pumping station was recently destroyed by fire. Steps will be taken at once to rebuild the plants. The town at present is without electric service.

RICHMOND, VA.—Contracts have been awarded by the Old Dominion Iron & Nail Works for the construction of a large steel plant on Belle Isle, in which electrical furnaces will be installed. Frank J. Gould is president and Thomas S. Wheelwright is vice-president and general manager.

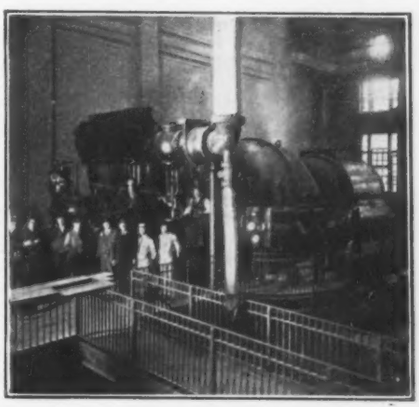
RICHMOND, VA.—The Administrative Board has authorized the city attorney to draw up the necessary papers for the purchase of the electric-lighting equipment owned by the Virginia Ry. & Pwr. Co., Richmond, in the northern territory recently annexed by the city, for which an appropriation of $6,363 has been made. The new territory will be served from the municipal plant.

WINCHESTER, VA.—Bids will be received by John M. Steck, president of the Common Council, until Oct. 29 for lighting the streets with electricity for a period of five years from June 1, 1916, as follows: (1) To supply and maintain not less than 75 or more than 100 electric arc lamps of 1200 cp.; (2) to supply not less than 25 or more than 100 incandescent electric lamps of 80 cp.; (3) to supply not less than 150 and not more than 200 incandescent electric lamps of 80 cp.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 9 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 8913—four blowers to deliver 1000 cu. ft. of air per minute; Schedule 8923—9000

Philadelphia's 30,000-Kw. Turbine Started "Two Minutes Under a Year" from First Steel Work to "Steam On"

At 3:18 p. m. Thursday, Oct. 7, exactly two minutes short of one year from the time, 3:20 p. m., Oct. 7, 1914, that the first steel column of the present building was put into place, the great 30,000-kw., twenty-five-cycle turbo-alternator of the Philadelphia Electric Company was turned over for the first time under the supervision of W. C. L. Eglin, vice-president of the company, and the engineers in charge of the work. The present huge unit and its 35,000-kw. companion turbine are the largest pair of prime movers in the world. The photograph at the left, taken a year ago, shows the first structural steel work being put into place in the new station building. On the right is a view of the generator room taken Oct. 7 of this year at the time of starting up the huge new turbine. A detailed description of the large Philadelphia units was given in an article on "Metropolitan Needs and Sizes of Prime Movers," which appeared on page 799 of the ELECTRICAL WORLD of Oct. 9.



ft. single-conductor wire; Schedule 8917—ten electric portable drills, five electric bench grinders; Schedule 8924—miscellaneous check valves and miscellaneous gate valves. Norfolk, Va., Schedule 8905—furnishing and installing one exhaust system; Schedule 8906—two polishing and buffing lathes; Schedule 8912—one power-gap shear and one rotary shear, with circular cutting extension; Schedule 8924—81,620 admiralty metal condenser tubes. Bids will also be received until Nov. 16 as follows: Mare Island, Cal., Schedule 8915—25 bells for motor boats; Schedule 8908—one radio motor-generator. Puget Sound, Wash., Schedule 8915—600 lb. sal ammoniac in 25-lb. jars. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 18,704—An American consular officer in India reports that a company in his district desires to be placed in communication with American manufacturers and exporters of electrical supplies, such as lamps, globes, shades, brackets, fixtures, fans, etc. Correspondence may be in English. No. 18,787—The bureau has received a report from an American consular officer in Canada stating that a firm in his district desires to communicate with American manufacturers of annunciator wire such as is used in connection with electric bells. The size required is No. 18. It is stated that orders of 500 lb. would be placed. No. 18,789—The commercial attaché of the Department of Commerce in England reports that a business man desires to represent American manufacturers or exporters of electrical household appliances, such as electrical irons. Further information may be obtained upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

North Central

ISHPEMING, MICH.—The Cleveland Cliffs Iron Co., Ishpeming, has awarded the contract for the erection of a power house, 26½ ft. by 32½ ft., at its Section 6 mine, in the North Lake district, to Louis Erickson & Son.

KALAMAZOO, MICH.—Bids will be received by the chairman of the building committee at the office of Howard H. Buckhout, steward Kalamazoo State Hospital, Kalamazoo, until Nov. 1, for the erection of a nurses' home at the Kalamazoo State Hospital, including general contract, heating, plumbing and gasfitting, electric wiring and equipment. Bids may be submitted on the entire work or separate divisions. Plans and specifications may be obtained at the office of the Wernette-Bradfield-Mead Co., engineers and architects, Grand Rapids. A deposit of $10 will be required for each set of plans.

MUSKEGON, MICH.—Steps have been taken to raise funds for the installation of ornamental lamps on Terrace Street. The plans provide for the erection of from 45 to 50 standards, to cost about $2,000.

ASHTABULA, OHIO.—Plans have been completed by W. C. Owen, architect, Leader-News Building, Cleveland, for the construction of the new building for the Cleveland Ford Tire Co. to be erected in Ashtabula. Bids, it is understood, will soon be called for. The plant will be equipped with motor-driven machinery. Electric generating units will be installed by the Westinghouse El. & Mfg. Co., Pittsburgh, Pa.

BETTSVILLE, OHIO.—Arrangements, it is reported, have been made with the Ohio Lt. & Pwr. Co., Tiffin, to supply electricity for lamps and motors in Bettsville. The service will be supplied from the high-tension line which runs from Tiffin to Fremont.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Oct. 27 for furnishing lead-armored cable for the Department of Fire. Specifications may be obtained upon application to the director of public safety.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Oct. 29 for paper-insulated, lead-covered cable. Specifications may be obtained upon application to the commissioner of the light and heat division, 1443 East Third Street, Cleveland.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Oct. 27 for furnishing one steam-turbine-driven generating unit for the Division Avenue pumping station. Application may be obtained upon application to the commissioner of water.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Oct. 27 for furnishing one steam-engine-driven generating unit for the Division Avenue pumping station. Specifications may be obtained upon application to the commissioner of water.

COLUMBUS, OHIO.—Application has been made to the Public Utilities Commission by the Ohio Service Co., with headquarters in Columbia and Coshocton, for permission to issue $88,000 in convertible notes and $12,000 in bonds, the proceeds to be used for the acquisition of some small companies operating in Eastern Ohio.

ELYRIA, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 19 for construction, including mechanical equipment and approaches, of the United States post office at Elyria. Drawings and specifications may be obtained at the above office or from the custodian of site at Elyria.

GALION, OHIO.—The Council has adopted an ordinance authorizing the service director to expend $800 for the purpose of employing an electrical engineer to make an inventory and appraisement of the municipal electric-light plant and install a classified system of accounts, to determine whether or not the rate for electricity can be reduced.

STEUBENVILLE, OHIO.—Surveys are being made by the East Liverpool-Steubenville Trac. & Lt. Co., Steubenville, for the proposed electric cable line to be erected from Newell to New Cumberland.

YOUNGSTOWN, OHIO.—The Mahoning County Lt. Co., Youngstown, has awarded the contract for the erection of a new building, 100 ft. by 94 ft., several stories high, to the Heller Brothers Co. The Council recently granted the company a franchise to furnish electricity in the city. The company has been authorized to issue $530,000 in bonds and $400,000 in capital stock.

YOUNGSTOWN, OHIO.—Preparations are being made by the Mahoning & Shenango Ry. & Lt. Co., Youngstown, for the erection of an addition to its Lowellville plant, increasing the generating capacity by 20,000 hp. Engineering and mechanical contracts have been awarded to the Stone & Webster Engineering Corpn., Boston, Mass. The cost is estimated at about $750,000.

COTTONWOOD FALLS, KY.—The Home Lt. & Pwr. Co., Cottonwood Falls, is extending its transmission lines into the country east of Cottonwood Falls, a distance of about 5 miles, to furnish electricity to farmers in that district.

CYNTHIANA, KY.—A deal has been closed whereby the property of the Cynthiana El. Lt. Co. has been taken over by the Kentucky Utilities Co., Lexington.

FLEMINGSBURG, KY.—The Flemingsburg Lt. & Ice Co. is changing its system from direct current to alternating current, 2300 volts. The company proposes to extend its transmission lines to supply electrical service to the surrounding towns and villages.

WHITESBURG, KY.—The installation of an electric-light plant in Whitesburg is under consideration. Wiley W. Gibson & Son, Mater, Ky., are reported to be interested in the project.

EVANSVILLE, IND.—The power station, we are informed, of the Evansville Pub. Ser. Co. was not destroyed by fire, as reported in the issue of Oct. 2. The bus structure was burned, causing an interruption of the service only a short time. The company expects to build a new switchboard some time during the next year. A. C. Blinn is general manager.

HUNTINGTON, IND.—The contract for installing the ornamental street-lighting system in Huntington has been awarded to the Central El. Co., South Bend, at $17,000. The plans provide for 391 nitrogen-filled lamps in the business district, maintained by underground wires.

LAPORTE, IND.—Terms have been agreed upon between the City Council and the Laporte Gas & El. Co. whereby a new contract will go into effect Jan. 1, 1916, under which the present arc lamps will be replaced with nitrogen-filled lamps of 400 cp.

CHICAGO, ILL.—The Public Serv. Co. of Northern Illinois, Chicago, has placed an order for a 10,000-kw. turbo-generator.

CHICAGO, ILL.—The Commonwealth Edison Co. of Chicago has placed a contract for a 35,300-kw., 60-cycle tandem-compound steam generator, to be installed in the Northwest station of the company.

STREATOR, ILL.—Plans have been prepared for the installation of an ornamental street-lighting system which provide for the erection of ninety ornamental standards mounted with nitrogen lamps of 400 cp. T. G. Essington is secretary of the Streator Commercial Association.

BIRCHWOOD, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., Eau Claire, is planning to install an electric-lighting system in Birchwood.

JANESVILLE, WIS.—The installation of an ornamental street-lighting system is under consideration by the City Council.

MEDFORD, WIS.—The Medford Lt. & Pwr. Co. is reported to be considering extensions and improvements to its plant.

MINERAL POINT, WIS.—The State Railroad Commission has granted the Mineral Point Pub. Ser. Co. permission to issue $50,000 in capital stock, the proceeds to be used for improvements to its plant and extension to lighting service and heating system.

OSSEO, WIS.—Bids will be received by the Board of Education, Osseo, until Nov. 1 for the construction of a public-school building. Separate bids to be submitted on heating and ventilating, electric wiring, plumbing and sewerage systems. Fellows & Hamilton, 6 North Clark Street, Chicago, Ill., are the architects.

AUSTIN, MINN.—A 1250-kw. Westinghouse turbo-generator is being installed in the municipal electric-light plant.

DULUTH, MINN.—Steps have been taken by the Hillside Commercial Club for the installation of an ornamental lighting system in that district.

MINNEAPOLIS, MINN.—An addition is being erected to the steam-power plant of the Minneapolis General Electric Co. at Twenty-ninth Avenue N. E. and the river, to cost with equipment about $600,000. The equipment will include a 15,000-kw. steam turbine, which will be used as an auxiliary to the present steam-power plant.

CORWITH, IOWA.—Bonds have been voted for the installation of an electric-lighting system in Corwith.

LAWLER, IOWA.—Bids will be received by the Town Council of Lawler on a small oil-engine-driven generating unit (directly connected) for the municipal electric-light plant. Further information may be obtained upon application to G. R. Shaw, light commissioner.

LUVERNE, IOWA.—The contract for the construction of 8 miles of transmission line, substation and distribution system in Luverne has been awarded by the Town Board to the McConnell-Lankford El. Co., Boone, at $8,918.

NASHUA, IOWA.—At a special election held Oct. 12 the proposal to grant the Cedar Valley Pwr. Co. a 25-year franchise in Nashua was carried. The company has purchased a power site for $35,000 and proposes to replace the present dam with a concrete structure.

OSAGE, IOWA.—Surveys are now being made in connection with the installation of an electric plant in Osage.

PERRY, IOWA.—An election has been called for Oct. 28 to submit to the voters a proposal to issue $5,000 in bonds, the proceeds to be used for extensions to the municipal electric plant. The proposed work includes addition to building, engine, large storage battery, tank, etc.

KANSAS CITY, MO.—The Kansas City Speedway & Exposition Co., recently chartered with a capital stock of $300,000, is planning to build an amusement park and is now building a speedway at Overland Park, on the Strang Electric line.

MAPLEWOOD, MO.—The City Council has granted the Western Pwr. & Lt. Co., a subsidiary of the Cupples Station Pwr. Co., a franchise to operate in Maplewood in competition with the El. Co. of Missouri.

POWERSITE, MO.—The Ozark Pwr. & Wtr. Co., Joplin, is contemplating the construction of a smaller dam, to cost from $15,000 to $20,000, on White River, about 70 ft. below the present reservoir, to remove the danger of the present reservoir being undermined. The company will also construct a retaining wall along the river below the dam.

SPRINGFIELD, MO.—Preliminary plans and estimates for a proposed municipal electric-light plant have been prepared by E. M. Stevens, consulting engineer, Kansas City, Mo. The cost of the plant is estimated at $400,000. The proposal to issue bonds will probably be submitted to the voters soon after the plans have been presented to the local committee.

WARRENSBURG, MO.—Bids will be received at the office of G. E. Hoover, registrar, Missouri State Normal School, Warrensburg, until Nov. 2, for construction of the administration building. Separate bids to be submitted for the installation of heating and plumbing system and for electric wiring. Plans and specifications may be obtained at the office of Smith, Rea & Lovitts, Finance Building, Kansas City,

Mo., for which a deposit of $25 will be required.

COOPERSTOWN, N. D.—Plans are being considered by the City Council for improvements to the electric-lighting system.

GLENBURN, N. D.—The Council has granted M. Thayer a franchise to install an electric-light plant.

WILLISTON, N. D.—The installation of an ornamental street-lighting system in Williston is reported to be under consideration.

EMERY, S. D.—The Bradley El. Co. has been granted a franchise to install and operate an electric-light plant in Emery.

BELLEVILLE, KAN.—The installation of an ornamental lighting system around the Court House Square and in other streets is under consideration.

MARYSVILLE, KAN.—Preparations are being made by the Marysville El. Lt., Pwr. & Wtr. Co. for the extension of its service to Blue Rapids, 18 miles distant, and to Waterville, 5 miles beyond. The transmission line is already erected between Blue Rapids and Waterville, and the line from Marysville to Blue Rapids is now under way.

WICHITA, KAN.—The Kansas Gas & El. Co., Wichita, has applied to the Public Utilities Commission for permission to issue $200,000 in bonds and $235,000 in capital stock.

Southern States

LUMBERTON, N. C.—Arrangements are being made for improvements to the municipal electric-light plant in Lumberton. The work will include the installation of one 125-kva., 60-cycle generator, switchboard, Westinghouse type, thirteen transformers, the erection of 300 poles and 6 miles of copper wire. Work will begin about Nov. 1. Tucker & Laxton, Charlotte, are engineers in charge.

ACWORTH, GA.—The City Council, it is reported, has voted to install new waterworks and electric-lighting systems. The present system will be abondoned and a 24-hour service established. Electric motors will be used to operate the pumps for pumping water from the artesian wells.

COLUMBUS, GA.—The City Council has decided to engage a consulting engineer to make investigations relative to the construction of a municipal electric-light plant.

CLEARWATER, FLA.—Application has been made to the Commissioners of Pinellas County by J. M. and J. N. McClung, Clearwater, for a franchise to erect and operate electric light and power transmission lines in the county. The system, it is understood, will be extended north to Dunedin and south to Indian Rocks.

FORT MYERS, FLA.—Plans are being considered, it is reported, by James A. Moore, Seattle, Wash., and other Western capitalists for the construction of an electric-lighting plant in Fort Myers. W. M. Butterworth, vice-president of the Florida Farm Co., has charge of the proposed development.

TITUSVILLE, FLA.—At an election held recently the proposal to issue $35,000 in bonds for the purchase of the plant of the Titusville El. Lt. Co. was defeated.

TULLAHOMA, TENN.—The Cumberland Springs Co. is contemplating the installation of an electric-light plant and other improvements.

GREENVILLE, MISS.—Plans have been prepared for the installation of an ornamental street-lighting system, which provide for the erection of 100 ornamental standards carrying three-lamp clusters (one 100-cp. lamp and two 40-cp. lamp) to be maintained by underground wires. The cost is estimated at from $4,000 to $5,000. As yet nothing definite has been decided upon. R. L. Pritchard is secretary of Chamber of Commerce.

GULFPORT, MISS.—The cost of the reconstruction of the overhead lines of the Gulfport & Mississippi Coast Trac. Co., damaged by the recent storm, is estimated at $25,000. The lighting system in Gulfport is badly crippled.

NEWPORT, ARK.—The Arkansas Lt. & Pwr. Co., Newport, it is reported, is planning to install two engines and a turbine pump of 1000 gal. per minute capacity for raising water for its boiler plant.

WOMBLE, ARK.—The Black Springs Lumber Co. is reported to have been granted a franchise to supply electricity for lamps in Womble.

STILLWATER, OKLA.—The electric light and water-works commissioners are contemplating the installation of a complete new generating unit in the municipal electric-light plant in the early part of 1916. George M. Smith is superintendent.

BEAUMONT, TEX.—Sealed bids will be received by the Board of Wharf and Dock Commissioners, City Hall, Beaumont, until Nov. 1, for furnishing material and for the following work at Kirby's Wharf, city of Beaumont: (1) Quay construction; (2) shed construction; (3) freight-handling machinery, including two traveling Gantry jib cranes, two overhead cranes with movable tracks and overhead carriers, with necessary appliances and appurtenances. H. McL. Harding is consulting engineer.

BRYAN, TEX.—Application has been made to the City Council by Fountain Brothers for a franchise to construct and operate an electric-light plant in Bryan.

DECATUR, TEX.—Improvements to the municipal electric-light plant, to cost about $10,000, are under consideration.

EDGEWOOD, TEX.—The construction of an electric-light system in Edgewood is under consideration. J. W. Freeman, Kilgore, is reported interested.

FORT WORTH, TEX.—A petition signed by the business men and property owners on Throckmorton and Monroe Streets has been presented to the City Commissioners asking that the ornamental street-lighting system be extended to those thoroughfares.

GATESVILLE, TEX.—An expenditure of $10,000 for the installation of a heating and power plant at the State Training School for Boys, near Gatesville, has been approved by Governor Ferguson. The proposed plant will be installed under the supervision of Patrick Bracken, master mechanic of the state penitentiary.

SHERMAN, TEX.—Plans are being considered for additions to the municipal electric-light plant. Considerable new machinery, it is understood, will be installed.

WACO, TEX.—Plans are being prepared by Ross & Cason, Waco, for extensive improvements to the local system of the Texas Tel. Co., including construction of exchange building, 55 ft. by 120 ft., three stories high, basement to contain repair shop, two vaults, dynamos and other electrical equipment, heating plant, etc. A switchboard, costing $60,000, has been purchased by the company.

Pacific States

CENTRALIA, WASH.—The City Commissioners have entered into a contract with Elmer Hayden, receiver of the Washington-Oregon Corp., whereby the company will furnish the city with electricity at a much lower rate than under the old contract. The commission has canceled the contract made with H. G. Freischhauer last June.

MONTESANO, WASH.—George H. Tilden, Hoge Building, Seattle, has made a second application to the Commissioners of Grays Harbor County for a franchise to erect transmission lines along the county roads.

PORT ANGELES, WASH.—The Port Angeles Tel. & Teleg. Co. is planning to extend its county system westward from Fairholme to Forks, where connection will be made with the Fair Service System.

SEQUIM, WASH.—The Sequim Lt. & Pwr. Co., recently organized, has taken over the holdings of J. L. Keeler, consisting of distributing system, franchise, etc., in Sequim. The company has a contract with the Olympia Pwr. Co. covering all territory in Ranges 2, 3, 4 and 5 of Clallam County. Work will begin as soon as possible in the development of this section.

TACOMA, WASH.—L. H. Bean, local manager of the Puget Sound El. Ry. Co., and the Tacoma Ry. & Lt. Co., has applied to the Commissioners of Pierce County for a franchise to erect transmission lines along the county roads in the districts of Puyallup, Burnett, Sumner, McMillan and Alderton. The petition asks for a time limit of three years in which to construct the line. Work will begin as soon as the franchise is granted.

AURORA, ORE.—The Molalla El. Co., Aurora, has been granted a franchise to supply electricity in Butteville. Nitrogen-filled lamps will be used for street lighting. Work will begin at once on the erection of the transmission line from Donald to Butteville, a distance of about 2½ miles.

PRAIRIE CITY, ORE.—Arrangements, it is reported, are being made by the Prairie Pwr. Co. to finance the construction of a hydroelectric power plant on the John Day River, 14 miles west of the city. The work includes 1 mile of open ditch, 3000 lin. ft. of wood-pipe line, forebay, waterwheel, generator, and erection of transmission line to Prairie City, 14 miles long.

BOLINAS, CAL.—At an election held recently the proposal to establish a lighting district in Bolinas was carried. The Supervisors have asked the Pacific Gas & El. Co. to consider the advisability of extending a transmission line along the coast section of the county to supply electricity to dairymen.

ESCONDIDO, CAL.—The City Council has passed a resolution authorizing an election to submit the proposal to issue $50,000 in bonds for the construction of a municipal electric-light and gas plant.

LA MANDA PARK, CAL.—Preparations are being made for the installation of an ornamental lighting system in La Manda Park, for which contracts will be awarded about Dec. 1. The plans provide for the installation of about 300 ornamental standards mounted with 100-cp. lamps maintained by underground wires.

MARTINEZ, CAL.—The Board of County Supervisors has granted the Great Western Pwr. Co., San Francisco, a franchise to erect electric transmission lines on certain roads in Contra Costa County.

BONNERS FERRY, IDAHO.—The Bonner Wtr. & Lt. Co. is contemplating an expenditure of $12,000 to extend the water-supply system to the North Side.

ROCKLAND, IDAHO.—Application has been made to the Public Utilities Commission by J. E. March and M. R. Stite for a certificate of public convenience and necessity permitting them to construct and operate an electric light and power plant in Rockland.

KINGMAN, ARIZ.—The Desert Pwr. & Wtr. Co., Kingman, expects to erect immediately a 44,000-volt transmission line from the Tom Reed Mine to Block Eagle Mine, a distance of 1 mile, and one to the United Eastern Mine, 1 mile long; also to erect at once a 44,000-volt, three-phase, 60-cycle transmission line from the power plant at Kingman to the Union Basin Mining Co. at Golconda, a distance of 14 miles. The company expects to purchase at once No. 4 copper wire, poles, steel or wood, insulators, etc., for the above lines. R. W. Wilde is vice-president.

PHOENIX, ARIZ.—All bids submitted for furnishing the city with 294 ornamental lamp standards, it is reported, have been rejected by Robert A. Craig, city manager. New bids, it is understool, will be asked for.

CHOTEAU, MONT.—The residents of Hobson Addition have presented a petition to the City Council asking for an extension of the electric-lighting system to that district.

ALAMOSA, COL.—The Colorado Pwr. Co., it is reported, is contemplating rebuilding the local distribution system and other improvements to plant, at a cost of about $20,000. J. V. Anderson is local manager.

FORT COLLINS, COL.—Condemnation proceedings are being conducted by the city to acquire a site for the proposed municipal electric plant.

GREELEY, COL.—The Greeley-Poudre Irrigation District has purchased from L. L. Stimson, Greeley, and the Greeley Hydro-Electric Co., all water rights formerly reserved by the Laramie-Poudre Reservoir & Irrigation Co., as well as all water rights acquired on the Cache la Poudre and Laramie Rivers in Colorado, which include the rights claimed on the water flow of the Greeley-Poudre tunnel, the Elkhorn Reservoir, and other reservoirs on the Cache la Poudre and Laramie Rivers.

Canada

BRANTFORD TOWNSHIP, ONT.—The Council has passed a by-law authorizing the township to enter into a contract with the Hydro-Electric Power Commission for electricity.

NIAGARA FALLS, ONT.—At an election to be held Nov. 3 two by-laws will be submitted to the ratepayers—the first to authorize the city to enter into a contract with the Hydro-Electric Commission of Ontario and the second to issue debentures to the amount of $14,000 for the purchase of the machinery and equipment of the city electric-light station.

PETROLIA, ONT.—The Town Council has decided to take over the electric plant of the Petrolia El. Lt., Ht. & Pwr. Co. at $11,280, the price set by the Hydro-Electric Power Commission.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Nov. 15 for copper cable and wire, steel reinforcing bars, steel wire, street lamps, water-gage lamps, etc. Blanks and general information relating to this circular (979) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 12, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,156,046. Safety System for Electric Railways; P. L. Bailey, Indianapolis, Ind. App. filed May 9, 1911. For trolley systems.

1,156,064. Electric Illumination; H. Deschere, New York, N. Y. App. filed March 19, 1913. Multi-filament lamp for signs.

1,156,089. Insulator for Overhead Conductors of Electric Lines; F. Libano, Trieste, Austria-Hungary. App. filed May 23, 1914. Porcelain insulator subjected only to compression strain.

1,156,113. Azimuth and Other Indicator; G. S. Tiffany, Summit, N. J. App. filed March 15, 1912. For transmitting motions of a pointer or telescope.

1,156,121. Combination Switch; A. F. Wise, Columbus, Ohio. App. filed April 4, 1914. For automobile ignition circuits.

1,156,136. Method of Operating Polyphase Motors; H. W. Doubrava, Hackensack, N. J., and J. Heineman, New York, N. Y. App. filed April 13, 1914. Does away with external appliances.

1,156,157. Receiver; O. M. Leich, Genoa, Ill. App. filed March 30, 1914. "Direct-current" type.

1,156,163. Manufacture of Insulators for High-Potential Electric Conductors; F. M. Locke, Victor, New York, N. Y. App. filed March 9, 1909. Glass base and boron material.

1,156,171. Carbonizing Pipe Bowls; W. A. Paul, Moline, Ill. App. filed April 4, 1914. Electric heater insertible in pipe bowl.

1,156,192. Apparatus for Improving the Stability of Furnaces with Magnetically Extended Electric Arcs; E. Troye, Christiania, Norway. App. filed Feb. 18, 1915. Central recess and ribs adjacent to electrode points.

1,156,201. Electric Switch or Contactor; T. E. Barnum, Milwaukee, Wis. App. filed Aug. 27, 1907. Special contact construction.

1,156,223. Electric Laundry Roll; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 9, 1914. Heater supported within hollow rolls.

1,156,226. Recording Electric Meter; A. Herz, Chicago, Ill. App. filed Aug. 15, 1911. For determining period of maximum demand.

1,156,227. Low-Resistance Vapor-Electric Device; P. C. Hewitt, New York, N. Y. App. filed Aug. 14, 1907. Container shaped to offer cooling surface.

1,156,228. Controlling Means for Vapor Apparatus; P. C. Hewitt, Ringwood Manor, N. J. App. filed Jan. 20, 1905. Strengthens normal initial resistance of negative electrode.

1,156,253. Telephone System; LeR. W. Stanton, Cleveland, Ohio. App. filed Nov. 8, 1912. "Semi-automatic." (Eighty-one claims.)

1,156,255. Combined Timer and Distributer; A. L. Strahle, Benson, Neb. App. filed March 4, 1914. Special features of a contact mechanism.

1,156,257. Gas or Vapor Electric Apparatus; P. H. Thomas, Upper Montclair, N. J. App. filed Sept. 12, 1912. Minimizes operating temperature.

1,156,282. Electric Switch; W. H. Farmer, Boothbay Harbor, Me. App. filed July 22, 1915. For ignition circuits.

1,156,288. Electric Typewriter; E. Hausberg, Des Moines, Iowa. App. filed Oct. 13, 1909. Has uniform printing action. (Thirty-two claims.)

1,156,314. Connector for Ground Terminals; A. R. Rheinberger, St. Paul, Minn. App. filed Jan. 10, 1910. Wedges for securing wire to terminal rod.

1,156,315. Electrode; W. H. Rowley, University, Mo. App. filed Dec. 16, 1913. Battery grid having ductile lead fibers.

1,156,316. Process of Making Electrodes; W. H. Rowley, St. Louis, Mo. App. filed April 5, 1915. Absorption removes excess moisture and then applies pressure.

1,156,321. Expression Device for Musical Instruments; M. L. Severy, Arlington Heights, and G. B. Sinclair, Winthrop, Mass. App. filed June 6, 1907. Simultaneously switches different resistances into the electromagnetic circuits.

1,156,334. Electrical Signaling System and Apparatus; C. W. Ward, Lakewood, Ohio. App. filed Nov. 1, 1911. Box signaling for electric railways.

1,156,344. Full Pendent Switch; F. A. Brogden, Syracuse, N. Y. App. filed July 12, 1912. Operating mechanism made readily accessible.

1,156,349. Connector for Electrical Conductors; H. E. Denman, Slayden, Tex. App. filed Jan. 31, 1914. For connecting wiring between railway cars.

1,156,352. Selective System and Apparatus; J. F. Engle, Cleveland, Ohio. App. filed May 5, 1909. Permutating switch construction.

1,156,364. Induction Motor; B. McCollum, Washington, D. C. App. filed Feb. 25, 1915. Nickel-steel alloy end ring.

1,156,366. Collision-Prevention Device; C. Martin, New York, N. Y. App. filed Sept. 18, 1914. For ships at sea.

1,156,412. Electric Wattmeter; P. M. Lincoln, Pittsburgh, Pa. App. filed Nov. 5, 1913. Lapse of time between energy flow and its indication.

1,156,413. Volt-Ampere Meter; P. M. Lincoln, Pittsburgh, Pa. App. filed Nov. 29, 1913. Indicates power-factor as well.

1,156,414. Electric Indicator; P. M. Lincoln, Pittsburgh, Pa. App. filed Nov. 12, 1914. Operated by reason of differential temperature.

1,156,415. Electrical Controlling Apparatus; D. L. Lindquist, Yonkers, N. Y. App. filed July 31, 1912. For furnace hoists.

1,156,416. Telephone-Exchange System; F. R. McBerty, Antwerp, Belgium. App. filed Jan. 21, 1914. Automatic switching apparatus.

1,156,426. Apparatus for Electric Welding; T. E. Murray, New York, N. Y. App. filed April 23, 1915. Mechanically controlled current of predetermined duration.

1,156,442. Insulator; L. Steinberger, Brooklyn, N. Y. App. filed April 17, 1914. Strain insulator.

1,156,450. Cord Circuit for Telephone Systems; B. D. Willis, Chicago, Ill. App. filed Oct. 4, 1911. For semi-automatic work. (Fifty-six claims.)

1,156,452. Insulating Composition; L. H. Baekeland, Yonkers, N. Y. App. filed Oct. 24, 1911. Contains phenolic condensation product and a solvent therefor.

1,156,453. Signaling System for Automobiles or the Like; E. T. Banes, Ogontz, Pa. App. filed July 14, 1914. Automatically indicates "slowing up."

1,156,475. Automatic Telephone Exchange System; C. L. Goodrum, Rochester, N. Y. App. filed March 10, 1905. Party-line service.

1,156,481. Electrical Controlling Apparatus; J. D. Ihdler, New York, N. Y. App. filed Aug. 5, 1912. Introduces variable resistance in dynamic circuit.

1,156,484. System of Motor Control; S. H. Keefer (deceased), Plainfield, N. J. App. filed March 17, 1913. Particularly for planers.

1,156,491. Frequency Indicator; D. R. Price, Lynn, Mass. App. filed July 13, 1912. Overcomes false indications.

1,156,502. Arc Welding; J. A. Seede, Schenectady, N. Y. App. filed May 11, 1914. Automatically controls connections to assure proper current flow.

1,156,509. Microphone; E. Weintraub and L. B. Miller, Lynn, Mass. App. filed Jan. 31, 1914. Uses hard-carbon granules.

1,156,524. Selenium Cell Especially Adapted for Use in Connection with Telegraphy; K. C. Cox, Norfolk Island. App. filed June 2, 1915. Low resistance.

1,156,526. Testing Cut-Out for Arc Lamps; E. J. Guay, Swampscott, Mass. App. filed Feb. 18, 1910. Closed testing circuit when lamp is out of service.

1,156,536. Illuminating Apparatus; W. Lumley, Conneaut, Ohio. App. filed April 22, 1913. Pole illuminated for indirect lighting.

1,156,537. Illuminating Apparatus; W. Lumley, Conneaut, Ohio. App. filed April 22, 1913. Pole illuminator.

1,156,542. Electric Switch; E. B. Merriam, Schenectady, N. Y. App. filed Feb. 11, 1915. Horizontal-brake oil switch.

1,156,583. Electric Conduit Fitting; C. H. Bissell and F. Smith, Syracuse, N. Y. App. filed Oct. 6, 1910. For receiving and supporting plurality of electric appliances.

1,156,610. Elevator Dispatcher; G. W. Meyers, Chicago, Ill. App. filed Oct. 12, 1914. Automatically gives starting signals.

1,156,625. Wireless Receiving Improvement; G. W. Pickard, Amesbury, Mass. App. filed Aug. 1, 1910. Amplifier of increased efficiency and dependability.

1,156,626. Telephone System; R. L. Quass, New York, N. Y. App. filed May 1, 1914. Central-energy type.

1,156,635. Flow Meter; J. W. Sheperdson, Johnstown, Pa. App. filed Oct. 15, 1910. For steam and the like.

1,156,636. Telephone Repeater; H. E. Shreeve, Short Hills, N. J. App. filed May 25, 1911. Readily replaced automatic adjustment.

1,156,639. Dynamo-Electric Machine; C. W. Starker, Pittsburgh, Pa. App. filed June 6, 1911. Laminated-core structure.

1,156,645. Dynamo-Electric Machine; M. Walker, Hale, Eng. App. filed May 16, 1910. Rotary converter.

1,156,650. Basing Incandescent Lamps; G. Wright, Schenectady, N. Y. App. filed Feb. 2, 1915. Mechanical connection between lamp bulb and base.

1,156,655. Circuit-Interrupting Device; W. M. Austin, Swissvale, and J. N. Mahoney, Wilkinsburg, Pa. App. filed Oct. 14, 1913. Three-pole carbon circuit-breaker.

1,156,565. Motor-Control System; H. L. Beach, Edgwood Park, Pa. App. filed Nov. 28, 1913. For series-mounted motors.

1,156,666. Electrolytic Rectifier; L. W. Chubb, Edgwood Park, Pa. App. filed Dec. 21, 1910. Electro-cooling means.

1,156,668. Electric Furnace; E. F. Collins, Schenectady, N. Y. App. filed April 17, 1914. Resistance type.

1,156,671. Electromagnetic Relay; E. B. Craft, Hackensack, N. J. App. filed Sept. 29, 1910. Compact and convenient size.

1,156,675. Dynamo-Electric Machine; H. F. T. Erben and W. J. Delles, Schenectady, N. Y. App. filed March 19, 1913. Compensating winding.

1,156,677. Apparatus for the Transmission of Energy by Electric Oscillation; R. A. Fessenden, Washington, D. C. App. filed Aug. 26, 1904. Uses auxiliary and two-branch receiving circuits.

1,156,679. Method of Changing the Composition of Iron and Steel; B. Ford, Philadelphia, Pa. App. filed April 13, 1905. For changing carbon contents and hardening.

1,156,681. Electric Switch; H. G. French, Schenectady, N. Y. App. filed March 21, 1911. Locked knife switch.

1,156,682. Motor-Control System; E. A. Hanff, Wilkinsburg, Pa. App. filed Dec. 4, 1913. For reversing series-wound motors.

1,156,686. Negative-Pole Plate for Secondary or Storage Batteries; G. M. Howard, Philadelphia, Pa. App. filed Feb. 16, 1910. Dry, active material containing metallic lead.

1,156,696. Electrode; C. R. Krueger, Schenectady, N. Y. App. filed May 31, 1912. Contains lithium compounds.

1,156,705. Fire-Alarm Box; A. Mozdzierz, Shelton, Conn. App. filed June 24, 1915. Has wrist-engaging mechanism.

1,156,711. Armature Winding; Y. Sakai, East Pittsburgh, Pa. App. filed Feb. 3, 1910. For single-phase alternating-current motors.

1,156,715. Electro-Osmotical Filter Press; B. Schwerin, Frankfort-on-the-Main, Germany. App. filed April 8, 1913. For peat, clay, etc.

1,156,717. Automatic Fire Alarm; J. B. Smith, Manchester, N. H. App. filed Aug 7, 1914. Weight supported by fusible material.

1,156,809. Burglar-Alarm Bolt; T. L. Pidgeon, St. Barnabe, Quebec, Canada. App. filed March 17, 1915. Sounds alarm when door is forced.

1,156,825. Gas or Vapor-Electric Apparatus; P. H. Thomas, Upper Montclair, N. J. App. filed Sept. 12, 1912. Minimizes changes in operating temperature.

1,156,826. Electrolytic Meter; J. N. Tuttle, Harwichport, Mass. App. filed Oct. 11, 1912. Actuated by decomposition of an electrolite.

1,156,827. Electric Meter; J. Vivell, Berlin, Germany. App. filed May 24, 1912. For excess consumption.

1,156,862. Pneumatic-Tire Gage; R. C. Sibley, Boston, Mass. App. filed April 26, 1910. Indicates to driver condition of tires at all times.

1,156,865. Sound and Light Amplifier; H. J. Farrar, Seattle, Wash. App. filed Jan. 27, 1914. Combined with ordinary electric-light bulb.

1,156,867. Universal Sound-Transmitting Means; P. J. Hackett, Seattle, Wash. App. filed July 6, 1914. Plurality of diaphragms.